Rashidova R.K., Kurbanov A.A., Abdullayev A.G.

A FEATURE OF THE USE OF REFRACTORY PRODUCTS IN METALLURGY IS THE PRESENCE OF VARIOUS TYPES OF LINING

Rashidova R.K. - Doctor of philosophy (PhD), Acting assistant professor Navoi state university of mining and technology, **Kurbanov A.A. -** Doctor of philosophy (DSc), assistant professor Navoi state university of mining and technology, **Abdullayev A.G. -** student 23a-21 RRM, Navoi state university of mining and technology

Annotatsiya: Jahonda turli xildagi o'tga chidamli va futerovkali issiqlik saqlaydigan materiallar (FISM)ga talab yildan-yilga ortib bormoqda. Bunday turdagi issiqlikka chidamli materiallar rangli va engillarni ishlab chiqaradigan metall pechlarida keng yordam beradi, sanoat korxonalari uchun katta rol o'ynaydi. Shu bois, alyumoslikatli va keramik mahsuloty xomashyolar asosidagi termik va fizik-mexanik yordamkichlari yuqori darajadagi FISM olish uchun zarur bo'lgan vazifalar.
Kalit so'zlar: issiqlik saqlovchi, sanoat korxonalari, keramik, xom ashyo, fizik-mexanik, termik.

Аннотация: В мире с каждым годом увеличивается спрос на различные виды огнеупорных и футерованных теплоизоляционных материалов (ФТМ). Жаропрочные материалы этого типа широко используются в печах цветной и легкой металлургии и играют большую роль в развитии экономики отрасли. Поэтому особое значение приобретает технология производства ФТМ с высокими тепловыми и физико-механическими показателями на основе алюмосиликатного и керамического местного сырья.
Ключевые слова: теплоизоляционные, промышленные предприятия, керамика, сырье, физико-механические, тепловые.

Abstract: In the world, the demand for various types of refractory and lined thermal insulation materials (FISM) is increasing year by year. Heat-resistant materials of this type are widely used in the furnaces of the non-ferrous and light metal production industry and play a major role in the development of the economy of the industry. Therefore, the production technology of FISM with high thermal and physical-mechanical parameters based on aluminosilicate and ceramic local raw materials is of particular importance.
Key words: heat storage, industrial enterprises, ceramic, raw material, physical-mechanical, thermal.

As a rule, refractory products are used with a small number of heat cycles. From development of high-tech industries, an increase in the number of private small-capacity enterprises engaged in the board of "light metals", more and more increased demand for ceramic lining heat-resistant products of functional appointments with an increased level of physical, mechanical, technological and performance properties. However, it must be taken into account that the process of their production requires special refractory tooling at FTK operations and chemical requirements, taking into account specific features of operating conditions. Of the variety of types of ceramics, the largest share in its production falls on the manufacture of products from ceramic materials, which corresponds to the mixtures of components proposed in this article minerals.

Main results and analysis. It has been experimentally revealed that the totality of the components materials "basalt:kaolin:chamoto" provides low firing temperatures FTK based on basalts firing temperature takes place at a temperature of 1000 to 1400ºC. About it evidenced by the studied and analyzed indicators of the physicochemical properties of basalts, kaolin and chamotte.

Based on the analysis of production features and requirements for heat-resistant types ceramic materials obtained on the basis of minerals, in particular - basalts, kaolin and fireclay has its own specific features and technical requirements. Requirements for production of ceramic-lining heat-insulating products, it is possible to formulate as requirements for refractory tooling necessary to obtain high-quality products [1-4]. According to the "two-stage" theory of the destruction of mineral rocks, the required value heat resistance can be achieved in two ways: by increasing the resistance of the raw material to external influences or slowing down the impact of their spread.

In recent years, often began to write about the environmental friendliness of raw materials and ensuring the quality of finished products. Therefore, we consider it appropriate to note that achieving the quality of manufactured products and meeting consumer demand, except for ensuring the specified standard requirements for products is still necessary ensure the quality of the most used raw materials. In our case the qualities of raw materials are considered: basalt rocks of the Aydarkul deposit, kaolin fireclay from the Karnab deposit.

Fireclay is obtained from the kaolin mineral by firing at a temperature of 1600÷1700ºC. At this temperature burns out all the impurities of the processed kaolin. Then skip the kaolin through a sieve, remove unnecessary additives. Basalt rocks are mined open method from the Aydarkul deposit. The analysis showed that in our case the most polluted the mineral turned out to be basalt minerals,

DOI 10.24412/2181-1431-2022-4-28-36

which cannot be purified from impurities without intervention of special technical means.

The basalts of Uzbekistan are the products of volcanic eruptions. The field of the Asian Ocean, which existed more than 500 million years ago. These basalts have been in the open for centuries space, under the influence of natural phenomena, settled on the surface of rocks cemented salts, muds, hydroxides, aerosols, etc. It should be emphasized that natural basalt stone, due to its high porosity, is prone to pollution and adverse influences of its environment.

Inside the premises, the basalt stone wears out and is exposed to household pollution. For this reason, basalt stone needs proper care, and this is the protection and cleaning of the stone [5-14]. Since the impurities located on the surface of the rock can freely mix with the main part of the raw material and the most affect the quality of products. However, the high cost of chemical cleaners in this case is an unattractive way to clean basalts from impurities.

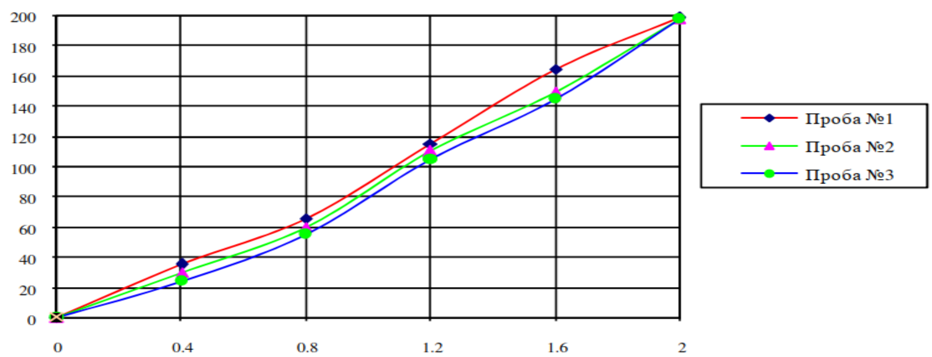
The reason for this is low productivity and high technological costs, which favor mechanical cleaning [11,13, 15, 16, 17].

Thus, it has been established that the ecological purity of basalt raw materials can only be ensured if, during processing, basalt rock is subjected to the simplest and cheapest way of mechanical cleaning. This method makes it easy to remove various hydroxides and salts from the surface of basalt pieces, thereby playing an important role in preventing spontaneous destruction of finished products and reducing the quality of finished products under the influence of harmful impurities. This method can be carried out by washing crushed basalts using metallurgical equipment "butara", which after disintegration is specialized for screening [2,13,15].

Materials and methods. In this process, the rock is fed for cleaning from sludge after medium crushing, large sizes 250÷300 mm into smaller pieces. After the first stage of rock crushing into surfaces of basalt rock may remain tightly adherent cemented layers of hydroxides and sludge, and in some cases traces of dirt. The process proceeds as follows. To begin with, basalt in separate pieces, the size 250÷300 mm is fed into the crushers, depending on the technical parameters of the equipment. At The choice of crushing plant capacity is based on the production capacity of the enterprise. It was revealed that when applying the technology of processing solid (3000÷5000 kgN/sm^3) basalts with jaw crushing is used to separate the harder rock fractions from less hard. At the same time, the standard technical capabilities of the crushing plant remain unchanged [3.14. 18.19]. After separating the solid part of the rock, it is transferred to the machine-butaru. Under the influence of the rotational movement of the machine drum, crumbs of basalt broken into smaller pieces and shaken out. The water supply at this point in the drum contributes to the loosening of raw materials. The presence of corners and ring thresholds inside the drum enhances the shaking of rock pieces and thereby creates an artificial washing. Dimensions holes in the walls of the drum, adjusted to the size of the crumbs, free from impurities of large pieces of basalt rock.

The effectiveness of the recommended cleaning method has been proven by conducting experimental study on the removal of cemented interlayers of hydroxides and slimes from the front surface of basalts. 200 kg of basalt samples were subjected to the experiment deposits "Aydarkul". After washing, all samples of basalt rock were subjected to drying. Studies show that after crushing and washing, the mass seen from 200 kg impurity rocks averaged 1.5 kg, of the total mass. Experiment results are shown in Fig.1. Initial mass of raw materials

Weight loss, kg



Rice. 1. Dependence of weight loss on the initial one during washing

Such an approach to performing operations is easily possible with the help of a grating wall of the butara, which in this case plays the role of a sieve, the size of which is adjusted to the size of the crumbs very in a simple way. In the course of the studies, it was found that the dependence thermal insulation properties of materials on temperature and humidity have very important scientific and practical value. In this case, one of the most important characteristics of raw materials is low thermal conductivity. And this, as

DOI 10.24412/2181-1431-2022-4-28-36

mentioned above, allows use an object with a lower heat exchange coefficient, which reduces the load on heat supply equipment. Since the heat exchange coefficient is the thermal conductivity helps to establish the isothermal energy transmitted per unit of time through a unit area surface at a temperature gradient equal to unity. Thermal conductivity coefficient λ are obtained in Vt/(mºK). Methods and methods for conducting thermal conductivity tests materials in different countries varies significantly, therefore, without fail data should be provided on the test conditions under which the measurements were made, e.g. about temperature, this will allow for a more thorough comparison of thermal conductivity various materials. The thermal conductivity of porous materials, including minerals, depends on the type, pore size and arrangement, material density, molecular structure and chemical the composition of the solid parts of the base, the type and pressure of the gas filling the pores, the coefficient radiation from the surface that bounds the pores. But the most important indicators of mineral materials recommended for the manufacture of basalt lining materials are their heat resistance and humidity. These factors have the greates influence on the coefficient thermal conductivity. An experimental study shows that of these two indicators humidity has the greatest influence on operating conditions, although with increasing temperature, the thermal conductivity of materials also increases significantly. Thermal conductivity thermal insulation and building materials significantly, also increases with the increase humidity. Thermal conductivity ‑ the ability of material bodies to conduct energy (heat) from more heated parts of the body to less heated parts of the body through the chaotic movement of body particles (atoms, molecules, electrons, etc.). Such heat transfer can occur in any bodies with heterogeneous. To quantify the thermal conductivity, there is a coefficient thermal conductivity of materials. The coefficient of thermal conductivity of the base structures should lie within 0.03-0.05 Vt / (mºK) [20-23].

Experience shows that the recommended composition of the FTC will constantly be influenced by thermal wave, and that is of no small importance in determining changes in the inorganic substances in a mixture of components "basalt:kaolin:chamotte". Therefore, in this case it was the method of IR spectrometry was used, which made it possible to elucidate the states of structural characteristics of these minerals. The study of structural changes in basalts in the process of thermal effects was carried out by studying the heat treatment of rocks, which relies on their inherent indicators. To determine changes in inorganic matter in basalts and constituents FTC used the method of IR spectrometry, which made it possible to determine the states structural features of basalt rock and constituent materials. Figure 2. images of IR spectrometry are presented.

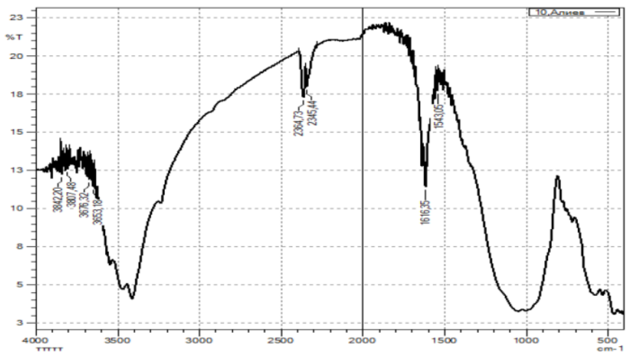


Fig. 2. IR spectra of Aydarkul basalts

Table-1. Main absorption bands of IR spectra of basalt

Absorption bands	**Wave number, sm^{-1}**	
	Original	**Product after heat treatment**
Al – O – Al	437,9	474,1
Al – O – Al	541,7	-
Al – O – Al	582,4	-
Si – O – Si	632,3	-
Si – O – Si	731,1	737,0
Si – O – Si	773,6	-
Si – O – Si	999,7	995,2
Al – O – Al	1102,9	-
Si – O – Si	1452,8	-
Si – O – Si	1642,9	-
Al – O – Al	2643,7	2636,3
Al – O – Al	-	3643,8
Al – O – Al	-	3739,4
Al – O – Al	-	3888,5

Identification of substances by IR spectra is carried out by comparing the full IR spectrum of the analyzed substance with the spectra available in the electronic library, as well as with standards spectra. The high resolution of the Nicolet 6700 spectrometer makes it possible to observe bands absorptions caused by a change in the dipole moment of a molecule during rotation or vibration of its constituent atoms, isotopic substitution in the molecule, its symmetry and the number electrons on the outer shells. The absorption band at 737.0 cm^{-1} refers to deformation vibrations of the Si-O-Si bond, and 474.1 sm-1- to the vibrations of the silicon-oxygen tetrahedron. An analysis of the IR spectra of basalts allows us to conclude that aluminum oxide completes polymer tetrahedral network of silicon-oxygen polyanion and is presented in the form $[AlO_4]^{5-}$. In the material under study, iron oxide, like aluminum, tries to complete its construction. Silicon-oxygen framework due to the lack of silicon oxide, in this case to a greater extent iron oxide is in tetrahedral coordination $[Fe_2+O_4]$.

To determine the changes in inorganic substances in kaolins and grog allowed to find out states of the structural features of the listed minerals. On fig. 3. Presented by IR spectra of kaolin and chamotte samples. Formation of a strong bond between the components of kaolin confirms the solid connection between rock grains, which were determined by calculation.

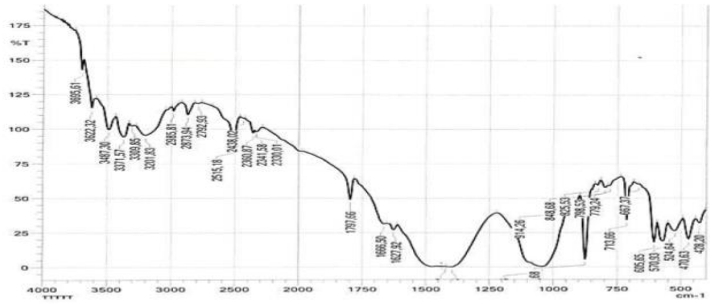


Fig. 3. IR spectra of samples of kaolin minerals and fireclay raw materials: a-kaolin from the Karnab deposit; b-chamotte obtained from kaolin "Karnab".

According to the results of the calculation and taking into account the specific features of the raw material used material for FTM, indicators: (according to options): a) = 3.0÷3.1gm3; on option b) = $1.7gm^3$; on the option c) = 1.4÷1.5gm3 and option a) = 1.7÷1.9gm3, which gives preference to kaolins "Carnab" than "Alliance" kaolin. Obtained from kaolin, by firing "chamotte" showed good results in density (p=3.5 gm3), which is higher than the density of basalt rock.

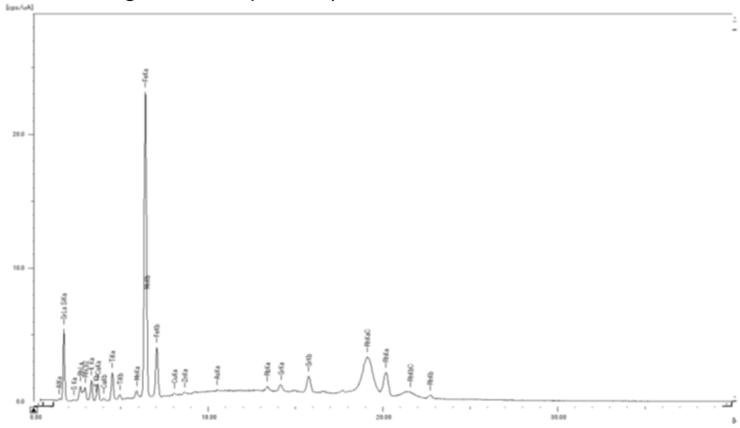


Fig. 4. X-ray pattern of basalt unfired FTM in the composition of basalt + kaolin + fireclay

Thus, according to the IR convergence of basalts from the Aydarkul deposit it was found that in the composition of this basalt rocks a strong bond of silicate connections.

Fired FTC, acquires the appropriate strength and standard shape, meeting all technological requirements of existing standards. The composition of materials obtained based on "basalt:kaolin:chamotte" were subjected to X-ray fluorescence analysis in the drive EDH-7000 (Shumardzi).

The above are confirmed by the results of X-ray examination presented in Fig.4. and 5 basalt FTC in the composition of basalt+kaolin+chamotte (in the ratio of masses: 50:20:30). The spectra of the chemical composition of composite materials before firing (at temperature 1300°C).

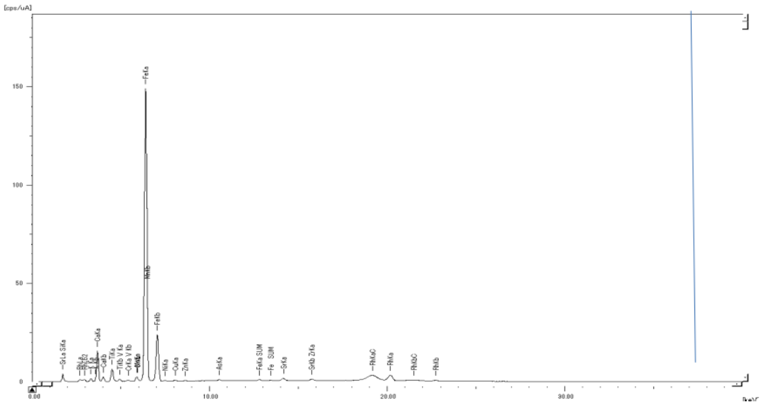


Fig. 5. X-ray pattern of burnt basalt FTM in the composition of basalt + kaolin +chamotte.

Study of the phase composition of the initial raw materials FTC and products of heat treatment of batches carried out using radiographic analysis. X-ray diffraction research was carried out on DRON 4-07, which was modified for digital processing signal. Filming was carried out on copper radiation (K) according to the Brega-Bretano scheme with a step of 0.020, exposure time at the point 1 sec, in the angular range 20–92 , with a voltage on the tube of 30 KVt and a beam current of 25 mA. Quantitative phase analysis was carried out by the full profile method [13].

On the X-ray pattern of basalt rock, diffraction maxima are pronounced quartz (d=0.474; 0.367; 0.182 Nm). In addition, studies have revealed the presence aluminosilicate compounds (d = 0.323; 0.296 Nm) and pyroxenes (d=0.253; 0.2015 Nm). Basalts are characterized by ionic and covalent bond types. Si - O and Al-O form in basalt minerals have a rigid directional covalent bond. Combining silicon-oxygen tetrahedra occurs by generalizing only the vertices of the tetrahedra, and not the edges or facets. X-ray analysis performed on a Bruker AXS D8 Advance diffractometer showed that the crystalline phases of materials are represented by calcite, anorthite, augite, chlorite, small amounts of magnetite and albite.

The results of an X-ray study of basalts showed that the mineralogical the composition of the crystalline phase is represented (in mass%) by calcite minerals $CaCO_3$-29.8; albite NaAlSi3O8 - 27.7; silicon SiO_2 - 35.9; alkaline basalt (Mg, Fe, Al, Ti) (Ca, Na, Mg, Fe) (Si, Al) 2O6-6.6. The intensity of the nonlinear background determines the total content of amorphous phases thermally treated basalts at 1000°C. Heat treatment of basalts at 1000°C explained with the onset of the softening temperature of the rock.

During heat treatment, a background is formed on the X-ray pattern and the expansion of the peaks; going on the formation of an anorthite phase (47.6%), in addition, the crystalline phase is represented by oxide calcium (19.5%) and alkaline basalt (21.2%), high-temperature quartz (11.7%). How It can be seen from the results that it is impossible to obtain an anorthite phase based on pure basalt. The results of X-ray graphic analysis helped to reveal that with heat treatment of the basalt composite make up the silicate compound of the rock: pyroxene, olivine and plagioclase and kaolin and chamotte minerals, which are to a significant degree affect the phase changes of the mineral raw material. Figure 5 shows the results of the chemical analysis of the components of the PTC fired in temperature range 900-1300^{o}C.

The data presented in table 2 shows its superiority compared tothermal stability by operating lining materials used in low-power metal-smelting furnaces. In this regard, the study and definition of structural change basalt is of particular interest due to the peculiarity of mineral compounds. Therefore, deviating from traditional composite lining materials, we study consequences of heat treatment of mineral rocks. They are different from traditional lining materials have low heat resistance, consists exclusively of mineral compounds, are based on intrinsic indicators and are used in proposed composition for the first time. Table.2 The results of the chemical analysis of the components of the FTM fired in the interval temperature 900÷1300^{o}C.

Name samples FTM	Temperature firing, oC	The content of oxides, on the components chemical elements in wt.%										p.p.p.	Σ	MO/ SiO2
		SiO_2	FeO_3	FeO	MnO_2	Al_2O_3	CaO	MgO	K_2O	Na_2O	TiO_2			
Components of the mixture	900	43,7	2,20	4,50	0,09	9,11	4,92	2,79	0,6	2,6	1,5	29,78	99,78	0,063
Components:	1000	45,11	2,72	4,80	0,013	9,45	5,4	2,97	0,7	2,6	1,5	24,70	99,70	0,065
"basalt:kao	1100	49,90	2,92	5,66	0,03	9,87	6,6	3,48	0,8	2,2	2,1	19,02	99,02	0,069

lin:chamotte"	1300	55,62	3,31	6,22	0,11	10,2	8,2	3,38	0,9	3,2	2,3	6,066	99,06	0,060

It was revealed that the chemical composition of the basalt rocks of the "Aydarkul" deposits has distinctive features in comparison with the data of the "Asmansai" deposit. For example, in composition of the basalts of the Aidarkul deposit, the content of silicon oxide reaches up to 63%, and in basalts "Asmansay" up to 53%, iron oxide up to 9%, and in basalts "Asmansay" up to 15 and 20%, in basalts "Aydarkul" did not find such chemical elements as Ib, Li, I and, on the contrary, in in the basalt of the Asmansai deposit, the content of Yb and J was not detected, etc. Overall analysis showed that the processing of Aydarkul basalts by melting is laborious and energy-intensive process with high technological costs. In the composition of the basalts of the Aidarkul deposit, olivine was found in the range of 13.7÷18.7%, pyroxene within 19.3÷23% and plagioclase - 34.6÷54%. Mineralogical composition of basalts Asmansay deposit contains: olivine within 11.7÷23.7%, pyroxene within 17.3÷21% and plagioclase 31.6÷50.1%. In the studied samples of basalt rock such chemical elements as Zn, Cd, Ag, Bi, Ge, Ti, Sb, W, Sn, In, As and P were not found in the Aydarkul deposit. the listed elements are present in a noticeable amount [15]. It was revealed that the oxide composition of basalt rocks is due to the forces of communication between oxygen and chemical elements of metals that form a rigid crystalline lattice. The bonds between oxygen and elements such as Al, Fe, Mg, K, N, Ti and Si [5].

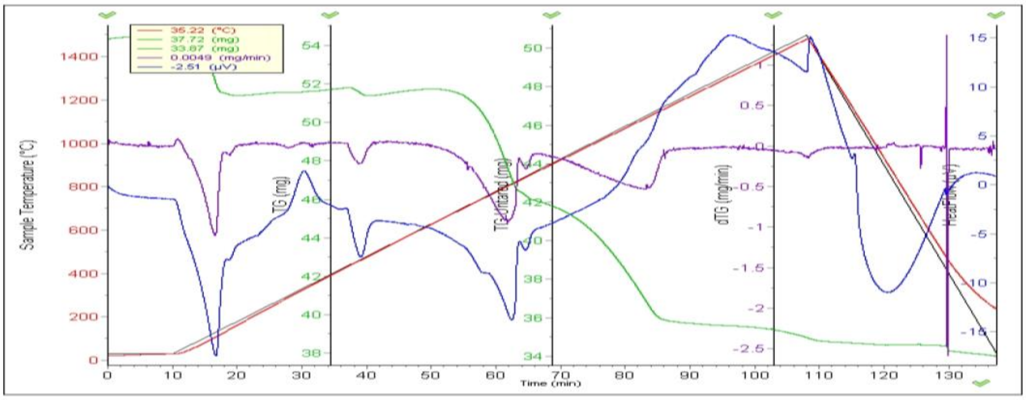


Fig.6. Derivatogram of heat treatment results "Aydarkul"

Comparative analysis of physical and chemical properties of selected minerals, showed that 24 chemical elements were found in the Aydarkul basalts, of which rock-forming are magnesium and sodium, silicon, iron, aluminum, calcium, the rest chemical elements in the rock are in small quantities. Final the result of chemical analysis was obtained after an experimental study to study the results of semi-quantitative spectral analysis of basalt rock breeds. Study of the process of thermal action on basalts, where the transformation takes place basalt rock, the derivatograms shown in Figure 6 were taken. In this The study used the LabsysEVO Setaram device. Where the heating temperature reaches from 50^0C up to 1200^0C. At the same time, the heating rate is 50 C/min. Based on the results of the derivatogram study, the samples were subjected to heat treatment at temperatures: 100, 300, 500,700, 900, 1000 and 1200^0C. For thermal processing used a muffle furnace. Studied manifestations of the endothermic effect thermolysis process, which appears at a temperature of $80÷240^0$C. They show decay clay impurities or removal of hygroscopic water contained in rocks.

Subsequently, at a temperature of 520^0C, a weakening of the effects and an increase by small amount of mass, which corresponds to the interconversion of the component basalts. Study of the process of thermal action on basalts, wheretransformations of basalt rock are expressed through derivatograms. In this study the Labybsys IVO device was used, where the heating temperature reaches from 50°C to 1200°C. Wherein heating rate 5°C/min. Differential scanning calorimetry (DSC) (4), dynamic thermogravimetric curves (DTGA) (2) and THP curves (3) of carbonaceous material. Analysis of the DTGA curve shows that the curve consists mainly of two sigmoids, which occur in two stages The first stage occurs in the temperature range from 150 °C to 700 °C, in this case, the mass loss is 11.46%, the second stage occurs in the temperature range from 750 °C to 1200 °C, while the mass loss is 23.7%. When heated to 600÷900 °C in in an oxidizing environment, the iron monoxide contained in olivine is oxidized to iron oxide, and olivine is transformed into forsterite (2MgOSiO2) and clinoenstatite (MgOSiO2). At temperatures above At 1200°C, iron oxide reacts with forsterite and forms magnesium metasilicate. Metasilicate magnesium has four modifications, so their presence in refractories is impractical.

The study and analysis of the TGP curve shows that the rate of decomposition of carbonaceous material in the temperature range of 600-1080 ° C flows to the maximum and is 2.88 mg / min and the amount of energy consumed, respectively, is 8.430 mv*c/mg. Differential Scanning Calorimetry (DSC) (4), dynamic thermogravimetric curves (DTGA) (2) and THP curves (3) of carbonaceous material.With an increase in temperature, the process of crystallization of amorphous products of the initial raw materials. At the same time, as a result of the destruction of the crystal structure of natural basalt, due to the heat treatment process causes the manifestation of the second exothermiceffect in the temperature range 820-840°C. This phenomenon can be explained by the discovery of raw materials appearing three endothermic effects (at temperatures of 120-160^{o}C, 335-375^{o}C, 580-590^{o}C respectively) and two exothermic ones (at temperatures 300-450^{o}C and 700-720^{o}C) effects.

It has been established that the shape of the thermal curves is related to the thermal insulation of the raw material and to characteristics of basalt deposits "Aydarkul" [24,25]. It should be noted that temperature transitions of endothermic and endothermic effects in composite samples, nor how they do not affect the quality of the obtained FTC and naturally depends on the inherent and real indicators of the constituent materials of the FTC. Temperature transition difference the FTC also directly depends on the chemical properties of the materials and the mineralogical composition. composite made on the basis of Aydarkul basalts. Thus, the results of differential thermal analysis of sample samples, based on of the studied FTC showed that the manufacture of FTC at a temperature range of 900-1200 ° C is of scientific and practical interest. In such cases, a specific feature of the rock, in particular basalts. Especially in this case, basalt can experience phase change in the chemical composition, restoration of the structure and properties of a liquid or solid phase of raw materials. It was found that if we take into account that the composition of basalts consists of: olivine containing $(Mg, Fe)_2$ SiO_4 and MgO, FeO, Na_2O and CaO radicals, then its melting point reaches 1250^{0}C; pyroxene – containing - $R_2[Si_2O_6]$, mainly consists of R–Mg, Fe, Ca, Al and Na radicals, temperature melting reaches 1450^{0}C and plagioclases - $Na[AlSi_2O_3]$, mainly consist of SiO_2, Al_2O_3, CaO, Na_2O, with impurities K and F and at that time represent an isomorphic series of albite and anorthite, which have different melting points, sometimes reaching 1550^{0}C, then the phase changes in basalt are inevitable[26].

In the temperature range of 1000÷1200°C, the process of new formations of FTK occurs, as a result which forms a dense composition, which helps to achieve a holding temperature of 1250^{o}C to 1400oC and above. With a further increase in the firing temperature (up to 1450°C) there is a softening of the composite, a change in shades and melting of the FTC. The dehydration process manifests itself in the form of small thermal effects in the region of 150-700ºC, not having obvious extremes accompanied by weight loss is 11.46%. Tagged the mineral contains water of a zeolitic nature and its release when heated is, as a rule, a continuous process is not clearly divided into separate stages, manifested at certain temperatures. In addition to these effects, when basalt is heated in the region temperatures of 600-700ºC, an endothermic reaction takes place. Presented figures corresponds to the release of structural water from basalt. And the next exothermic effect in the temperature range within 750÷1200ºC (in this case, the weight loss is 23.7%) associated with the process of formation of $Mg[SiO_4]$ which proceeds according to the reaction:

With a significant amount of iron in the basalt fraction, in addition to forsterite, to form and fayalite. The melting of fayalite proceeds according to the reaction: $Fe_2[SiO_4]$ 2FeO+SiO2, at a temperature of 1200÷1210^{0}C. The results of the analysis show that the rate of decomposition carbon-containing material in the temperature range of 600-1080 ° C proceeds to the maximum and is 2.88 mg/min and the amount of energy expended, respectively, is 8.430 mv c/mg, which leads to $3Al_2O_3$ $2SiO_2$ mullite formation. Obviously, this result creates condition for increasing the refractoriness of the lining material. The phase composition of a well-fired FTK composite is mainly built from the relationship crystalline phases of silicate compounds: pyroxene, olivine, plagioclase and chamotte. These silicate compounds undergo a structural change and, as a result, products are created interconversions. Conclusion Results of differential thermal analysis of prototypes based on basalts deposits "Aydarkul" showed that in the process of heating raw materials FTC 500°C its dehydration begins, ending at 900 ° C and accompanied by oxidation ferrous oxides to ferric oxides. As can be seen from the results of the study, the curves differential thermal analysis are typical for ordinary mineral natural silicate compounds of rocks. As the temperature rises, it softens materials that consist of a combination of "basalt:kaolin:chamotte", i.e. FTK.

In general, the conducted comprehensive (according to GOST ISO 5725-1) studies of basalts allowed evaluate the features of material and chemical compositions and establish numerous endo- and exo effects on heating and cooling. Comparison of basalt rocks with coexisting normal basalts of Uzbekistan, as well as basalts of other regions showed that there is a significant difference in chemical and mineral composition and among indicators of technological properties. Thus, according to the totality of the estimated and specified parameters obtained in the process theoretical, experimental and precision studies, it can be established that basalts of the "Aydarkul" deposit have a low indicator of suitability for use them as a raw material for the production of basalt fiber. They may be recommended for organization of production of non-fibrous basalt products, where basalt rocks subjected to "dry processing". A joint general analysis of the chemical composition of basalts by scientists of

Navoi State Mining Institute and the Central Scientific Research Laboratory of the State Enterprise NMMC showed that in the composition of the basalt rock of the Aydarkul deposit, the SiO2 content is in the range of 43.7÷59.9%. According to the method of S.D. Belinkin, an increase in the content of SiO2 in basalt contributes to increase in the melting point of the rock. Therefore, for the production of fiber products basalts with such a high content of SiO_2 are considered unsuitable and advisable use "Aydarkul" basalts; process by "dry processing», without melting operations. These statements are confirmed by research results. presented in tables: 6-7. As a result, physicochemical studies of HM samples based on basalt silicate compounds, it was found that these basalts can be suitable for the manufacture of acid-resistant tiles, refractory materials, Portland cement, as well as for the manufacture of composite materials and heaters. By crushing basalt and further firing it, which corresponds to the correct choice of the object of study and basalt raw materials.

Thus, it was experimentally revealed that the material ratio of the component's silicate compounds in the composition of the basalt rock of the Aydarkul deposit equated: olivines within 13.7÷18.7%, pyroxenes within 19.3÷23% and plagioclases - 34.6÷54%. Such ratios of the constituent silicates are inappropriate to subject to smelting operations due to the high demand for energy resources. Therefore, practically an expedient option is to process Aydarkul basalts with such a composition without melting operations.

References:

[1]. Kurbanov A.A., Zhiyanov A.B., Nurmatov Zh. The prospect of expanding the scope special materials based on basalts Scientific, technical and industrial journal "Mountain Bulletin of Uzbekistan". Navoi, - 2020. No. 3. - 55÷59 p.

[2]. Rashidova R. K. Nurmatov J. T., A. A. Kurbanov. Comparative Analysis of the Physical and Chemical Properties of Uzbekistan's Basalts and Ways of Solutions to the Problems of Choice of Raw Processing Directions Land Science; Vol. 1, no. one; 2019https://doi.org/10.30560/ls.v1n1p59- 62Published by IDEAS SPREAD), p 38-42.

[3]. Rashidova R. K. Nurmatov J. T., A. A. Kurbanov, Turdiyeva Nurmatov J. T. Heat Processing and Change of Proper Indicators of BasaltsLand Science; Vol. 2, no. 2; 2020 ISSN 2690-5418 E-ISSN 2690-4802.

[4]. Sanakulov K.S., Khasanov A.S. Processing of slag from copper production. Tashkent 2007.p. 248

[5]. Kurbanov A.A., Abdurakhmanov S.A. Scientific practical foundations of integrated use of different types of basalts of Uzbekistan. Navoiy 2018. p.-239.

[6]. Kadyrova Z.R., Pirmatov R.Kh., Eminov A.A. Promising raw materials of Uzbekistan for obtaining refractory materials. 2019. - 10-17 p.

[7]. Pashinkin A.S. Complex use of mineral raw materials. 1984 #1. pp.46-48

[8]. Kadyrova Z.R., Eminov A.A., Bugaenko V.A., Sabirov B.T. Research of raw materials and waste industry of Uzbekistan for the production of refractory materials. Refractory and technical ceramics, Russia, - 2010, No. 4, P. 64-67. Web of science (1), Scopus (3), Springer (11), IF -0.251. Resarch Gate (40) IF-0.590.

[9]. Kurbanov A.A. On the thermal balance of the furnace for melting basalt stone. Scientific technical and production journal Mountain Bulletin of Uzbekistan. Navoi, - 2005. No. 4. - 89 p./52; -p.10-17.95; -239s.,105; -p.46-48.106: -p.64-67.107; -89s.].

[10]. Kurbanov A.A. and Turaev A.S. A brief overview of basalt and the resulting basalt materials. Scientific, technical and production journal Mining Bulletin of Uzbekistan. Navoi, 2007.- No. 3.-S. 82-85.

[11]. Rashidova R.R., Kurbanov A.A., Aliev T.B. Khasanova N.A. Comparative analysis of physical chemical properties of basalt rocks to select criteria for the release of various products / Scientific, technical and industrial journal "Gorny Vestnik Uzbekistan". Navoi, - 2020. No. 1. - 38÷40 p.

[12]. Shevchenko V.P., Gulamova D.D. etc. Obtaining and studying the properties of basalt fibers based on natural raw materials of Uzbekistan//Chemistry and chemical technology. - Tashkent, 2011.-№2.-p. 10-12.

[13]. Shohruh Shonazarovich, Y., &Abduraxim Axmedovich, K. (2021). INVESTIGATION OF THE QUALITATIVE, PHYSICOCHEMICAL AND MINERALOGICAL PROPERTIES OF THE RAW MATERIAL INDEX OF MINERAL LINING BRICKS. Middle European Scientific Bulletin, 17, 23-40. Retrieved from

[14]. https://cejsr.academicjournal.io/index.php/journal/article/view/760

[15]. Rashidova R.K., Kurbanov A.A., Turdieva O.D., Yuldoshev Sh.Sh. Physico-thermal study of samples of basalt heat-insulating lining material. O'zbekistonkonchilikxabarnomasi No. 4 (87) 2021.76-81. Retrieved from http://gorniyvestnik.uz/ru/posts/965-fiziko-termicheskie-issledovaniya-obrazcov-bazaltovogo-teploizolyacionnogo- uterovochnogo-materiala

[16]. Rashidova, R. K., Ahmedovich, K. A., Aliyev, T., Jiyanov, A. B., Turdieva, O. J., & Nurmatov, J. T. (2020). Heat Processing and Change of Proper Indicators of Basalts. *Land Science*, *2*(2), p1-p1.

[17]. Nurmatov, J. T., Kurbanov, A. A., & Rashidova, R. K. (2019). Comparative Analysis of the Physical and Chemical Properties of Uzbekistan's Basalts and Ways of Solutions to the Problems of Choice of Raw Processing Directions. *Land Science*, *1*(1), p59.

[18]. Kurbanov, A. A., Rashidova, R. K., Yarlakabov, S., Umurzakova Sh, U., & Halimov Sh, I. (2019). On some possibilities of temperature regulation of basalt-melting apparatus. *Zarafshon voҳasini complex innovation rivozhlantirish youtuқlari, muammolari va istiqbollari mavzusidagi qalgaro ilmiy amaliy konferentsi materialari*, 27-28.

[19].Рашидова, Р. К., & Хасанова, Н. (2021). АНАЛИЗ И РАСЧЕТ ЭНЕРГЕТИЧЕСКИХ ПАРАМЕТРОВ БАЗАЛЬТОПЛАВИЛЬНОЙ ПЕЧИ. In *МОЛОДОЙ УЧЁНЫЙ* (pp. 18-20).

[20].Курбанов, А. А., Нурматов, Ж. Т., Рашидова, Р. К., Умрзакова, Ш. У., & Абдуллаева, А. О. (2019). ФОРМИРОВАНИЯ ЖИДКОГО БАЗАЛЬТА И ЕГО СТРУКТУРНЫЕ ОСОБЕННОСТИ. *Международный академический вестник*, (5), 123-125.

[21].Рашидова, Р. К., & Утамуродов, Э. А. ГЕОЛОГИЧЕСКИЕ СТРОЕНИЕ МЕСТОРОЖДЕНИЕ ЧАРМИТАН, ОСОБЕННОСТИ И ФАКТОРЫ, ОПРЕДЕЛЯЮЩИЕ ЛОКАЛИЗАЦИЮ ОРУДЕНЕНИЯ.

[22].Курбанов, А. А., Нурматов, Ж. Т., Рашидова, Р. К., Умрзакова, Ш. У., & Абдуллаева, А. О. (2019). ФОРМИРОВАНИЯ ЖИДКОГО БАЗАЛЬТА И ЕГО СТРУКТУРНЫЕ ОСОБЕННОСТИ. *Международный академический вестник*, (5), 123-125.

[23].Хидиров, Х. И., Қаюмов, А., & Рашидова, Р. (2021). КОРРУПЦИЯГА ҚАРШИ КУРАШ БОРАСИДАГИ ФАЛСАФИЙ ПАРАДИГМАЛАР. *Scientific progress*, *1*(4), 93-98.

[24].Рашидова, Р. К., & Хасанова, Н. (2021). АНАЛИЗ И РАСЧЕТ ЭНЕРГЕТИЧЕСКИХ ПАРАМЕТРОВ БАЗАЛЬТОПЛАВИЛЬНОЙ ПЕЧИ. In *МОЛОДОЙ УЧЁНЫЙ* (pp. 18-20).

[25].Курбанов, А. А., Нурматов, Ж. Т., Рашидова, Р. К., Умрзакова, Ш. У., & Абдуллаева, А. О. (2019). ФОРМИРОВАНИЯ ЖИДКОГО БАЗАЛЬТА И ЕГО СТРУКТУРНЫЕ ОСОБЕННОСТИ. *Международный академический вестник*, (5), 123-125.

[26].Курбанов, А. А., Нурматов, Ж. Т., Халилова, Ш. И., Рашидова, Р. К., & Абдуллаева, А. О. (2019). ПРОЦЕСС ОЧИСТКИ МИНЕРАЛЬНЫХ ПОРОД ОТ ПРИМЕСЕЙ. *Международный академический вестник*, (5), 125-127.