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PHYSICO-CHEMICAL INVESTIGATIONS OF THE COMPOSITION OF BASALT OF THE AYDARKUL DEPOSIT

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ABSTRACT
The chemical composition of the basalts of the Aydarkul deposit is studied in the article. To determine the changes in inorganic substances in basalts, the IR spectrometry method was used, which made it possible to determine the state of the structural features of the basalt rock and constituent materials. It has been established that the polyoxide composition of basalt rocks is due to the bonding forces between oxygen and the chemical elements of metals, which form a rigid crystal lattice. The bonds between oxygen and elements such as Al, Fe, Mg, K, N, Ti and Si stand out in particular.

Keywords: Mud, basalt, crystal lattice, dipole moment, mineral, rock.

Introduction

The demand for various types of refractory and lining-heat-insulating materials (FLM) is growing year after year all over the world. The reason for this circumstance is that these types of heat-insulating materials are widely used in nonferrous and light metal furnaces, which play an important role in the development of the sectoral economy. In this regard, the development of a technology for obtaining FLM with high thermal and physical-mechanical parameters based on local aluminosilicate and ceramic raw materials is of great importance. Scientific research is being carried out on the development of lining heat-insulating materials, on the modern innovative technologies for their production, the development of high-temperature technological processes and modes, materials from cheap raw materials that are resistant to

high temperatures, as well as having physical and chemical properties and environmental cleanliness.

In this regard, it is necessary to pay special attention to the burning processes, where at the initial stage of processing of raw materials, physical and chemical changes take place that occur in semi-finished products and their additives, the creation of a ceramic-crystalline phase, which has a different effect on the association of the basalt- kaolin, fireclay binder, fractional composition, as well as determining the effect on samples obtained the optimal composition.

Our joint analysis of the chemical composition of basalts in the Central Research Laboratory of the State Enterprise NMMC and the laboratory of the Bukhara State University showed that the content of SiO_2 in the composition of the basalt rock of the Aydarkul deposit reaches up to 57,1%. The high content of SiO_2 in the Aydarkul basalts contributes to an increase in the melting temperature of the rock and an increase in technology costs. Therefore, for the production of products by casting, the basalts of this deposit are ineffective. The latter is confirmed by the stoppage of mining of raw materials and the abandonment of the use of Aydarkulbasalts due to the high cost of smelting operation [1-3].

The study put forward the idea of using a mixture of local mineral raw materials to develop an FLM technology for lining the inner face of small-scale light metal smelting furnaces. This was necessary to determine the optimal ratio of minerals used for the manufacture of FLM.

According to the existing standard technology, basalts are usually ground on laboratory grinding mills. The crushed raw materials are screened on a vibrating sieve, the screened are ground in mills and partly in a grinding balls to obtain a fine fraction. After dosing, mixing of the components of the refractory additive: kaolin and chamotte is carried out in mixing mills and laboratory bringing ball. At the same time, the molded samples are dried in air and in an oven at 100-110^oC. In the studies, mini aggregates were used: for crushing – DSh06, for grinding – MDSH and sieves with an opening size of 0,40-0,074 mm. In the experiment, basalt – 10, kaolin – 10 fireclay 10 (kg) were used as raw materials.

Each mineral was processed separately. They were first milled and then crushed. They subjected to screening with washing, drying and mixing, making a wet thick mass, shaping, drying and burning.

It was revealed that the chemical composition of the basalt rocks of the Aydarkul deposits has distinctive features compared to the data of basalts from other deposits in Uzbekistan. The final result of the chemical analysis was obtained after an experimental study of spectral analysis of the Aydarkul basalt rock. In the composition of the basalts of the basalts of the Aydarkul deposit, olivine was found in the range of 13,7-18,7%, pyroxene in the range of 19,3-23% and plagioclase – 34,6-54%. The main constituents of basalts are: SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O, K_2O. 15 samples were selected for chemical analysis. The experimental study was carried out in the laboratory conditions os the Central Scientific Research Laboratory of the State Enterprise NMMC. The results of the study of all samples are presented in table 1.

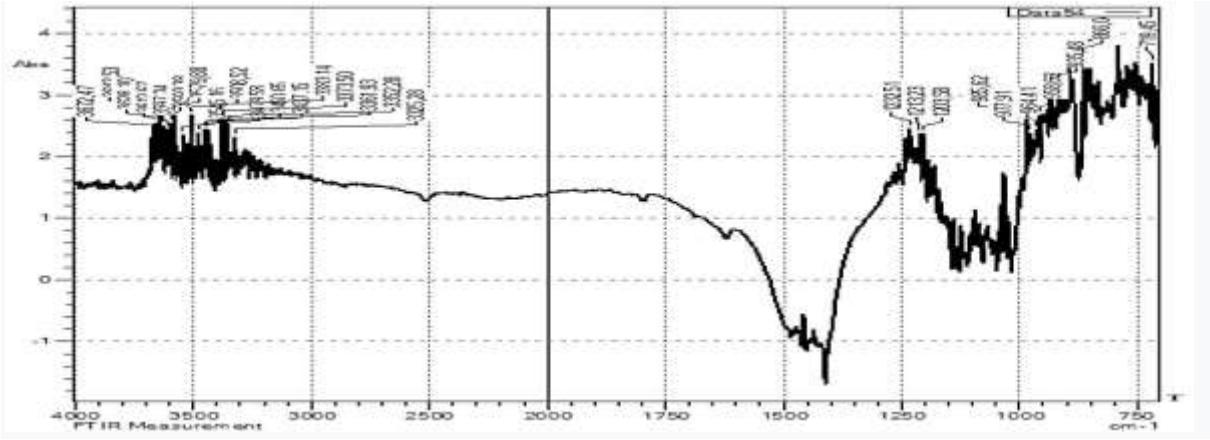
Table 1 Chemical composition of basalts from the Aydarkul deposit

Sample №	SiO_2	TiO_2	Al_2O_3	CaO	MgO	FeO	Fe_2O_3	K_2O	Na_2O	MnO_2	P_2O_5	H_2O	Others	
													Content. < 1%	slimes
1	49,7	1,9	9,05	9,67	3,8	5,6	3,4	0,11	4,23	0,05	0,08	1,01	3,1	,3
2	50,3	2,5	11,2	7,8	2,8	4,9	4,0	0,11	3,3	0,09	0,05	1,1	2,9	8,6
3	52,9	2,1	10,2	10,8	2,65	5,9	3,9	0,14	4,3	0,01	0,02	1,09	1,11	4,88
4	47,7	1,98	7,2	8,89	2,75	4,6	3,87	0,11	2,3	0,05	0,08	1,04	8,17	11,26
5	57,1	1,9	9,67	11,18	2,53	5,6	3,9	0,14	3,11	0,16	0,05	1,02	0,87	2,77
6	56,8	1,77	10,9	7,95	2,69	6,9	3,87	0,1	4,13	0,033	0,02	1,03	0,73	3,07
7	55,9	2,5	8,27	10,45	3,44	6,55	3,9	0,17	4,53	0,05	0,01	1,01	0,53	2,69
8	54,44	2,44	9,43	9,9	2,81	6,6	4,9	0,14	3,31	0,001	0,02	1,01	0,71	4,19
9	53,9	1,79	7,2	9,87	3,0	4,6	2,9	0,14	3,3	0,03	0,08	1,1	2,12	9,97
10	47,7	2,2	11,1	10,12	3,2	4,65	2,3,0	0,13	3,13	0,06	0,04	0,98	6,63	10,06
11	53,21	2,27	8,28	9,76	3,4	4,6	2,9	0,15	2,86	0,16	0,06	1,05	5,71	5,59
12	54,4	1,9	11,2	6,8	3,0	4,66	2,97	0,15	2,89	0,11	0,05	1,07	4,16	6,45
13	52,9	2,45	9,07	7,89	3,5	5,6	3,0	0,21	3,53	0,15	0,02	1,07	7,7	10,94
14	43,71	1,91	10,07	10,28	3,1	4,76	2,9	0,13	3,23	0,18	0,06	1,03	4,11	5,05
15	51,9	2,2	10,72	9,7	2,9	5,3	3,4	0,14	3,34	0,19	0,03	1,02	5,64	4,6
∑	52,1	2,1	9,5	9,4	3,0	5,3	3,4	0,13	3,4	0,08	0,04	1.04	3,81	6.56

The spectral analysis results presented in the table represent 24 chemical elements found in the Aydarkul basalts. Of these, rock-forming are magnesium and sodium, silicon, iron, aluminum, calcium, the rest of the chemical elements in the rock are in a small amount.

The IR spectrometry method was used to determine the changes in inorganic substances in basalts, which made possible to identify the state of the structural features of the basalt rock and its constituent materials. Figure 1 shows images of IR spectrometry of a sample of basalt from the Aydarkul deposit.

The high resolution of the Nicolet 6700 spectrometry (USA) makes it possible to observe absorption of its constituent atoms, isotopic substitution in the molecule, its symmetry, and the number of electrons in the outer shells.



Pic.1 IR-basalt spectra of the Aydarkul deposit

The absorption band at 737,0 cm-1 refers to the bending vibrations of the Si-O-Si bond, and 474,1 cm-1 refers to the vibration of the silicon-oxygen tetrahedron. Analysis of the IR spectra of the basalt melting product allows us to conclude that aluminum oxide completes the polymer tetrahedral network of the silicon-oxygen polyanion and is presented in the form $[AlO_4]^{-5}$. In the material under study, iron oxide, like aluminum, tries to complete the silicon-oxygen skeleton due to the lack of silicon oxide; in this case, iron oxide is mostly in tetrahedral coordination $[Fe^{2+}O_{4/2}]$. The mineralogical composition of the basalts of the Aydarkul deposit contains: olivine in the range of 13,7-18,7%, pyroxene in the range of 19,3-23% and plagioclase 34,6-54%. In the studied samples of basalts rock from the Aydarkul deposit, such chemical elements as Zn, Cd, Ag, Bi, Ge, Ti, Sb, W, Sn, In, As and P were not found. The content of silicon oxide in the basalts reaches up to 63%, the chemical elements like Yb, Li, I, and the content of Yb and I, etc. were not delected. In general, the analysis showed that the prosessing of Aydarkul basalts by melting is a labor-intensive and energy-intensive process with high technological expences.

It has been established that the polyoxide composition of rocks is caused by the power of relation between oxygen and elements of metals, which form a rigid crystal lattice. The relation between oxygen and elements such as Al, Fe, Mg, K, N, Ti, and Si stand out in particular.

Thus, the chemical elements of the proposed mixture, constituting the FLM components, create a strong structure. They consist mainly of SiO_2, FeO, Fe_2O_3, Al_2O_3, MgO, TiO and other metal-containing oxides, making possible to obtain a combined material with an exceptionally strong structure. Particularly the inorganic constituents of silicate compounds are considered to be significant to affect the inherent and technological performance of the product.

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