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THE STUDY OF THE PHYSICAL AND MECHANICAL PROPERTIES AND THERMAL CONDUCTIVITY COEFFICIENT OF ULTRA-LIGHT CONCRETE OBTAINED ON THE BASIS OF LOCAL VERMICULITE

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Abstract:

This article examines the issues of creating effective components of vermiculite slab, thermal insulation, sound-absorbing, refractory ultra-lightweight concrete with functional properties obtained on the basis of foamed vermiculite and studying their properties.

Keywords: : Foamed vermiculite, portland cement, liquid glass, thermal conductivity, thermal conductivity, strength, foaming coefficient, pressing, drying.

ENTRANCE PART: As a result of the reforms implemented in our republic, the production of building materials and products based on local raw materials is expanding today. The decision of the President of May 23, 2019 No. PQ-4335 "On additional measures for the rapid development of the construction materials industry" was issued. According to this decision, the works to be carried out in the building materials industry during 2019-2025 have been specified. [1]

The identified reserves of vermiculite raw materials in the world are more than 100 million tons, according to estimates, the unexplored reserves amount to more than 200 million tons. South Africa, USA, Russia, Uganda and China have large reserves of vermiculite. There are also vermiculite reserves in Argentina, Australia, Canada, Brazil, Egypt, India, Japan, Kenya, Zimbabwe, Kazakhstan and Uzbekistan.

In Uzbekistan, vermiculite is available in the "Tebinbuloq" mine located in the territory of Karaozak district, Republic of Karakalpakstan. The identified reserve of vermiculite ore is 3,944,000 tons. As of January 1, 2021, 6 licenses for the right to use the Tebinbuloq vermiculite mine and 3 licenses for geological exploration have been issued to local entrepreneurs. According to estimates, 592,000 tons (3,944,000 tons or 15 percent) of vermiculite concentrate can be obtained from the identified existing reserves.

MATERIALS AND TECHNIQUES USED: Experimental work was carried out using industrially mined vermiculite ore from the Tebinbulok vermiculite mine in the territory of the Republic of Karakalpakstan, which was licensed to "TRIUMF-GORNYAK" LLC.

For the production of vermiculite slabs, the raw materials and selected composition were carried out in the following sequence:

- sieving of mined vermiculite concentrate, separation into small and large fractions;
- determination of specific gravity;
- determination of the chemical composition of vermiculite concentrate;
- Multiply vermiculite concentrate in a conveyor oven at a temperature of 870-950 °C;
- determination of specific gravity of expanded vermiculite;
- mixing raw materials components;
- pressing a vermiculite slab sample in a hydraulic press;
- drying vermiculite slab samples in a tunnel dryer;
- determining flammability;
- determination of heat transfer coefficient;
- determination of sound transmission coefficient;
- determination of strength to bending and compression;
- determination of impact resistance.

RESULTS OF EXPERIMENTAL WORK: Expanded vermiculite grains are divided into fractions of 0.5-1.0 mm, 1.0-1.6 mm, 1.0-3.0 mm and 5-8 mm according to their size: small - from 0.5 to 3 mm and large - 5 mm to 8 mm. Expanded vermiculite by volume weight is divided into the following brands: 100, 150, 200, 250 and 300. Expanded vermiculite grains have a large deformation: they are slightly compressed, as a result, vermiculite becomes denser. The chemical composition of the vermiculite sample used as raw material in the tests is presented in table 1. [2].

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Chemical composition of vermiculite concentrate

Table 1

№	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	TiO_2	Cr_2O_3	Mn_2O_3	P_2O_5	P.P.P.
1.	36,08	14,43	12,77	3,69	14,90	0,11	0,00	5,69	1,35	0,0287	0,1404	0,00	4,75

Vermiculite volume weight and grain strength depend on its cooking and cooling conditions: when vermiculite is heated to 800-950 ^{0}C, the grain strength decreases. Expanded vermiculite is a heat-insulating material characterized by its high porosity, lightness and certain temperature resistance. Experimental work was carried out according to GOST 7076-99 [4].

Materials and equipment for the experimental work were carried out using the equipment available in the laboratory to determine the coefficient of thermal conductivity of heat-retaining construction materials and mechanical properties:

- samples of vermiculite slabs for experimental testing;
- determines the heat transfer coefficient (XND-2-3030C model car);
- hydraulic press;
- barbell circular ШЦ-25 250;
- metal ruler MC;
- electronic scale CZ-3.

Figure 2. Determining the bending and compressive strength of the vermiculite plate by experimental tests.

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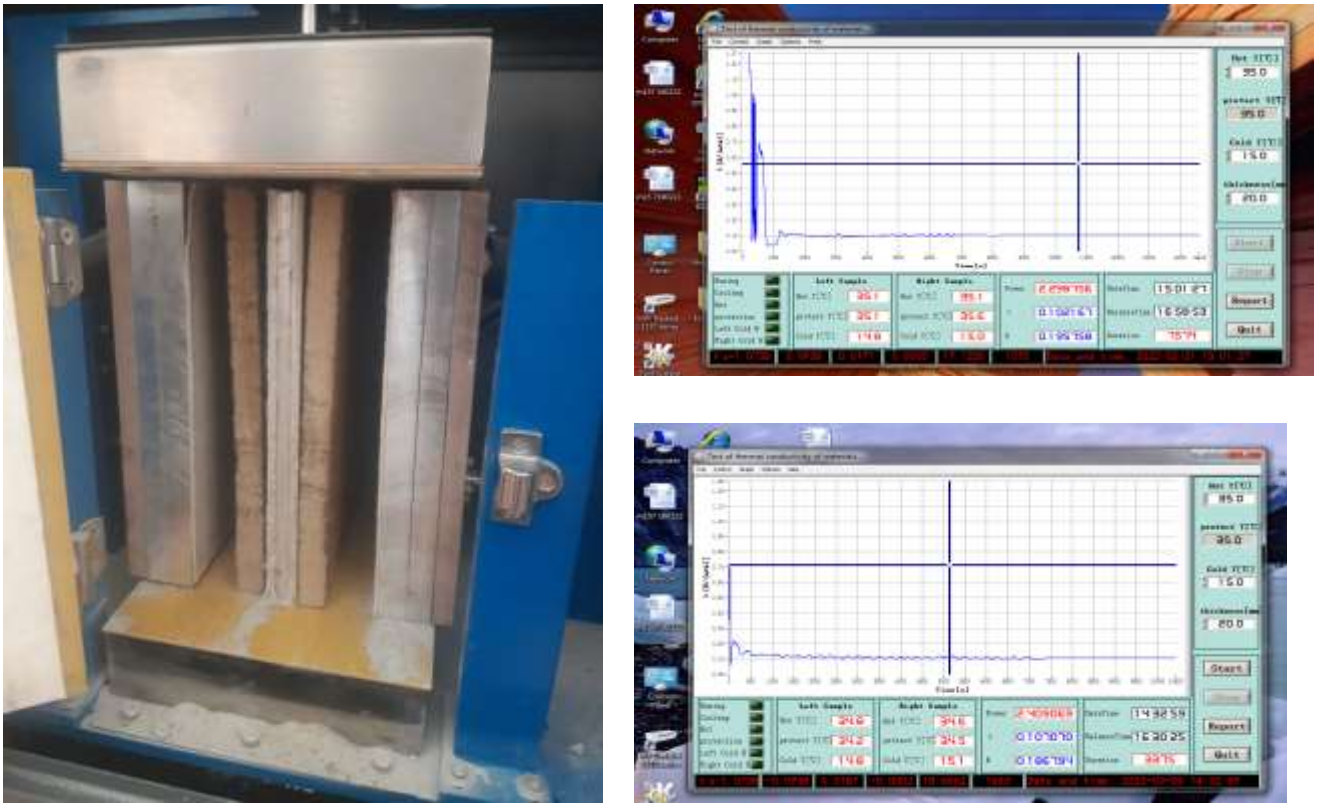

Figure 3. (model car XND-2-3030C) Determination of heat transfer coefficient of vermiculite plate.

Physico-mechanical properties of an experimental plate based on expanded vermiculite
Table 2

№	Technological parameters	Inspection methods	Indicators
1.	Sound transmission coefficient	ГОСТ 23499-2009	0,5 (f=500 Gs)
2.	Heat transfer coefficient	ГОСТ 7076-99	0.102167 Vt/m*°C
3.	Bending strength	ГОСТ 17177-94	1,9 Mpa
4.	Compressive strength	ГОСТ 17177-94	2,4 Mpa
5.	Flammability	ГОСТ 30244-94	700 °C
6.	Impact resistance	ГОСТ 11842-2021	2560

The vermiculite sheet production line enables movement through the initial components and binder, mixer, distributors for batch production of components and binder, forming block, pressing, drying chamber, re-edge trimming device, and the finished product is produced.

CONCLUSION: The conducted scientific research shows that the thermal conductivity coefficient of the vermiculite plate obtained as a result of experiments ranges from · = 0.10 W/m*^{0}C to · = 0.11 W/m*^{0}C, and the heat transfer resistance R=0.17 m^2*K/W R=0.19 m^2*K/W gave the result. Flexural strength R_e=1.9 MPa, compressive strength R_s=2.4 MPa were obtained. The experimental samples were tested in

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laboratory conditions for their physical, mechanical and technical parameters in accordance with the requirements specified in the current normative documents.

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