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Heat Protection Boards Based on Multiply Vermiculite Heat Conductivity Coefficient Determine

B.T. Sabirov[1], M.A. Tillaev[2], F.F. Omonov, I.M. Abdurakhmonov[3]

[1]Ph.D., (DSc) senior researcher
[2]PhD student
[3]students of Jizzakh Polytechnic Institute

Abstract: In this article, the effective composition of heat-shielding plates obtained on the basis of expanded vermiculite is developed and the coefficient of heat transfer is considered.

Key words: Expanded vermiculite, thermal conductivity, expansion, hydrogen peroxide, expansion coefficient, molding, bulk density.

Introduction

The demand for energy resources in the world and the constant growth of their cost require the introduction of energy-efficient materials and technologies, especially in construction. In this regard, it is important to increase the volume of production of materials used for heat insulation in developed countries, including countries such as the USA, Germany, Japan, China, and Russia, to use industrial waste in production, to optimize the composition and properties of heat-insulating materials, to reduce their cost, and to increase their efficiency. is earning.

Used materials and methods: Experimental and test work. To study the differences between the physical and technical properties of vermiculite expanded by traditional thermal and chemical methods under the influence of N2O2, to determine which method is technically and technologically acceptable, two main important indicators of expanded vermiculite - coefficient of expansion and bulk density was carried out based on the comparison of indicators. In the following tables, the expansion coefficient and bulk density indicators of vermiculites multiplied by traditional thermal and chemical methods under the influence of N2O2 are compared with the results obtained based on the multiplication of the two most commonly used fractions of vermiculite, i.e. 0.8÷1.6 mm, 1.6÷2.2 mm fractions. done through 0,8 ÷ 1,6 мм 1,6÷ 2,2 мм

a)

0,8 ÷ 1,6 мм **1,6÷ 2,2 мм**

б)

Figure 1. Examples of thermally (a) and chemically (b) propagated vermiculites

It can be seen from the above tables that when we compare the physical and technical parameters of vermiculites propagated by traditional thermal and chemical methods under the influence of N2O2, there are also differences in the color changes during the propagation process, that is, if it turns orange-golden in the thermal method, it changes to a color close to light green in the chemical method, as well as in the chemical method It was found that the expansion coefficient of N2O2 expanded vermiculite is 50-60% higher than conventional thermally expanded vermiculite according to different fractions of vermiculite.

Table 1

Multiplication of vermiculite concentrate under the influence of H2O2 and multiplication coefficients of multiplied vermiculite

№	Grain sizes of vermiculite concentrate fraction, mm	Bulk density of vermiculite concentrate, g/cm3	Bulk density of multilayered vermiculite, g/cm3	Multiplication coefficient
1.	0,8÷1,6	1,017	0,145	7,01
2.	1,6÷2,2	0,990	0,155	6,83

Figure 2. As a result of increasing the concentration of vermiculite the change in the correlation between the multiplication factor

Results of pilot work: Raw material components and additives for development in pilot work are:

- expanded vermiculite (in two fractions of 0.8÷1.6 and 1.6÷2.2 mm), liquid glass.

In order to carry out laboratory studies, a total of 6 experimental compositions were developed based on increased vermiculite fractions of 0.8÷1.6 and 1.6÷2.2 mm and using sodium liquid glass as a mineral binding component. Samples of experimental plates were prepared from mixtures and combinations of the above-mentioned experimental compositions. For this, the raw material components were weighed on a laboratory electronic scale, then the raw material components were placed in a mixer, and two different fractions of expanded vermiculite with a size of 0.8÷1.6 and 1.6÷2.2 mm taken as small and large fillers were added and mixed for 3 minutes. mixed in a mechanical stirrer during 5 minutes, and as a binder, liquid glass is added to the dry mixture, mixed for another 5 minutes, and then plate samples are molded from the mixture.

Plates made of thermally expanded vermiculite

Sheets made of chemically multiplied vermiculite

Figure 3. Vermiculite plates of different composition obtained in laboratory conditions, multiplied by experimental chemical method

Before that, the laboratory muffle furnace is preheated, the temperature in its inner chamber rises to 550-570 oS and is kept at this temperature. From the ready-made mixture mixed with binder, i.e., liquid glass, the mixture was poured into a 300x125x80 mm metal mold with a thickness of 20±40 mm and kept in a high-temperature oven at 500-550 oS for 25 minutes.

Acceptable M-3 content consists of increased 60% vermiculite (in two different fractions of 0.8÷1.6 and 1.6÷2.2 mm), 40% - liquid glass [4]. Since the coefficient of thermal conductivity of air is extremely low (l=0.02), the thermal conductivity of the material depends on whether the pores are filled with air, gas or water. Because l of water is equal to 0.58, and that of ice is equal to 2.3 W/m.oS. As the temperature rises, the λ of most materials increases, but that of some materials (metals, magnesite refractories) decreases. "GOST 7076-99 Construction materials and products. Method for determining thermal conductivity and thermal resistance in the stationary thermal regime. Identified by "Official publication" [7-9].

The obtained results showed that the thermal conductivity coefficient of the vermiculite plate obtained as a result of the experiments ranges from =0.055 W/m*oS to=0.087 W/m*oS, and the thermal resistance R=0.30 m2*K/W to R=0. It was found that it has values in the range of up to 54 m2*K/W. The experimental samples were tested in laboratory conditions for their physical, mechanical and technical parameters in accordance with the requirements specified in the current normative documents [10].

Laboratory research work on determining the heat transfer coefficient of the samples of plate No. 1-No. 3 obtained on the basis of increased vermiculite was carried out on the XND-2-3030 C machine. The technical conditions for determining the heat transfer coefficient of the samples and the results of the determination are presented in Figures 4.

Figure 4. Plate obtained on the basis of expanded vermiculite XND-2-3030 C of sample #1 on the machine the results of determining the heat transfer coefficient

Thus, during the research, the thermal conductivity coefficient (□) and thermal conductivity resistance (R) of experimental samples of vermiculite plates were determined (Table 2).

Table 2

The results of determining the thermal conductivity coefficient and thermal resistance of vermiculite slabs samples using the XND-2-3030C machine

Indicator name	**Вермикулитли плита намуналари**		
	№1 (20mm thick)	**№2** (30 мм thick)	**№3** (40 мм thick)
Sample dimensions, (mm)	300x300x20	300x300x30	300x300x40
Heat transfer coefficient, ,W/m*oS	0,065506	0,055502	0,087161
Heat conduction-moisture resistance R, m2*K/W	0,305316	0,540523	0,458923

Conclusion: The conducted scientific research shows that it is possible to recommend the appearance and durability of the sample vermiculite plates obtained as a result of the experiments, to be tested on the production conveyor line of this composition in the industrial-class size. The thermal conductivity coefficient of the vermiculite plate obtained as a result of the experiments ranges from □= 0.055 W/m* 0S to □= 0.087 W/m* 0S, and the heat transfer resistance R=0.30 m2*K/W to R=0.54 m2*K/ It gave a result in the range of W. Experimental samples were tested in laboratory conditions for their physical, mechanical and technical parameters in accordance with the requirements specified in the current normative documents.

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