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New Silicate Fire- And Heat-Protective Compositions Based on Local Mineral Raw Materials and the Study of Their Properties

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Abstract: The authors of the article provide information on the research carried out to obtain new silicate fire and heat-protective compositions based on local raw materials, including the study of their properties.

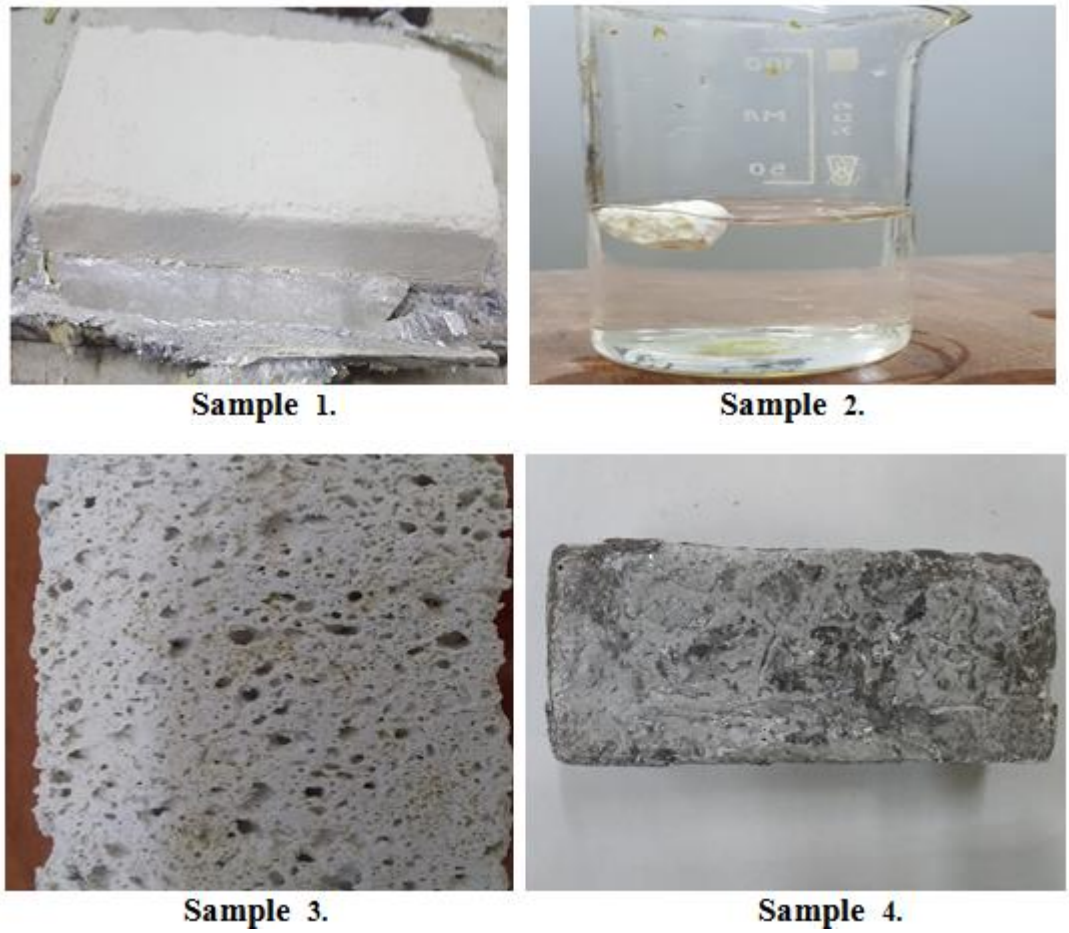
Keywords: new porous fire and heat-shielding materials, sodium water glass, dolomite, wollastonite, finely dispersed wollastonite, synthesis of new materials, experiment.

In order to develop effective porous compositions and materials based on local mineral raw materials, a series of experiments on their synthesis were carried out. At the first stage of research, based on the available raw materials of sodium liquid glass, dolomite and other additional reagents, new porous compositions were synthesized. [1-5].

Below are the developed method for obtaining and a series of experiments on the synthesis of new compositions of porous materials. The method of their preparation is as follows: in a three-necked flask with a round bottom equipped with a mechanical stirrer, a dropping funnel and a thermometer, liquid glass (1300-1500 ml) and dolomite were mixed for 40 minutes in a ratio of 3:1 by weight. Through an addition funnel, with constant stirring, 50 ml (30%) HCl was added dropwise. After adding the acid, the resulting mixture was continued to mix until a cloudy dispersion consistency was formed. The medium solution was slightly acidic (pH = 6.5 - 7). The resulting mass was poured into a special mold covered with foil from the inside. Next, the mold was placed in an electric furnace brand SNOL 8.2/1200, where boiling was carried out at a temperature of 4000C for 2 hours.

The resulting thick sticky mass was cooled in the open air. After that, the resulting product was crushed and sown using a Ø160 mm sieve (having 0.5 mm mesh) and was processed with the addition of 50 g of an organic additive. After that, the object was repeatedly kept in the oven at 7000C to evaporate the remaining gas (for about 2 hours). Next, the resulting product was cooled in the open air, since when hot, the product acquired the property of adsorbing moisture.

After cooling, the product was dried in an SSH-80-01-SPU oven at a temperature of 1000C for 5 hours. The resulting product acquired a silvery color and high porosity, including properties such as fire resistance (does not burn at 11000C) and ultra-lightness (ρ=1>) and buoyancy in water.



Picture-1. Photographs of synthesized samples of new silicate compositions and materials based on them

On the basis of the experiments carried out, new porous compositions were synthesized and, on their basis, samples of porous materials were obtained, which were further studied to determine their various physicochemical properties (Table 1. and Table 2.).

The density of the obtained samples varies within 416-3401 kg/m3 (Fig. 1 Samples 2,3 and 4 and Table 1.).

Table 1. Conditions for obtaining new tile materials

Sample number	Compound	Temperature, ^{0}C	pH
1.	ЖС+ДТ+H^+	300-400	6,5-8
2.	ЖС+мс+ H^+	400-450	6,5-8
3.	ЖС+ДТ+HCl	350-400	6,5-8
4.	ЖС+ДТ+Al_2O_3	350-400	6,5-8
5.	ЖС+ДТ+$CaSiO_3$	300-400	6,5-8
6.	ЖС+ДТ+ cement	300-400	6,5-8
7.	ЖС+ДТ+NaOH	300-400	6,5-8
8.	ЖС+ДТ+ glycerol	350-400	6,5-8
9.	ЖС+ДТ+$CaCO_3$	350-400	6,5-8
10.	ЖС+ДТ+ vermiculite	350-400	6,5-8

The pH conditions of the medium where the synthesis of new porous compositions was carried out were determined, which are given in Table 2.

Table 2. Chemical composition and conditions for the synthesis of new porous materials

№	Samples	Состав	Compound	Density (kg/m3)
1.	Sample 1	ЖС+ДТ+H^+	700 ^{0}C	696
2.	Sample 2	ЖС+мс+ H^+	700 ^{0}C	2649
3.	Sample 3	ЖС+ДТ+HCl	1000^0 C	1036
4.	Sample 4	ЖС+ДТ+Al_2O_3	1000^0 C	540
5.	Sample 5	ЖС+ДТ+$CaSiO_3$	1200^0 C	620
6.	Sample 6	ЖС+ДТ+ cement	1100^0 C	651
7.	Sample 7	ЖС+ДТ+NaOH	1100^0 C	416
8.	Sample 8	ЖС+ДТ+ glycerol	500^0	1617
9.	Sample 9	ЖС+ДТ+$CaCO_3$	500^0	1432
10.	Sample 10	ЖС+ДТ+ vermiculite	500^0	2107

To accurately determine the conditions on the basis of which new compositions of porous materials were synthesized, measurements were carried out on modern laboratory facilities, including a pH meterpH-150MI (for measuring the acid-base balance) and a TM-5133 meter (for measuring high temperatures up to 12000C). Thus, based on the experimental data obtained above, it became known that the conducted studies and measurements made it possible to accurately establish and develop the parameters of the conditions for the synthesis of new porous materials.

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