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Modified Forest Ceramics for Wall Products with High Quality Indicators

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ABSTRACT On the basis of substandard raw materials in the laboratory, the possibilities of obtaining mechanically durable, salt-resistant bricks for masonry walls of industrial and individual houses in saline soils were established. Further studies have outlined field experiments in the Aral Sea region.

KEYWORDS: loess, loam, ceramics, ceramic brick, mechanical indicator, clinker brick.

I. INTRODUCTIONS

In the construction of individual houses, industrial facilities of environmentally distressed regions, especially with saline soils, the applied building ceramic brick wears out quickly due to environmental aggressiveness, resulting in their premature failure. In this regard, the development of technology for producing ceramic bricks with high mechanical properties and chemical resistance is of current importance. The most acceptable material in such conditions is a special type of ceramic brick, the so-called clinker brick, obtained, as a rule, from high-grade high-quality white-burned refractory clay with a wide sintering interval. The deposits of such clays in the Republic of Uzbekistan are limited. In recent years, a number of foreign scientists have been studying the possibility of using loess loam as the main component of a ceramic composition when producing clinker building bricks [1-2]. Loess loam is considered a common raw material [3]. In the Republic, scientific research aimed at the development of compositions and production technology of clinker bricks was almost not carried out, but the products are not produced at all, and the demand for such materials is not very limited.

II. MODIFICATION VALUE

In this paper, the issues of obtaining clinker brick from loess loams, the study of raw materials and improving the composition of the mass are considered. In earlier papers [4–5], the compositions and physicochemical properties of the initial raw materials of the experimental compositions were reported. As noted in [6], depending on the composition and sintering mode, ceramic materials can contain both amorphous and crystalline solid phases, a differently formed pore space, and a heterogeneous grain composition. Taking into account these factors, we have developed in laboratory conditions the composition of brick masses for chemically resistant clinker bricks. The selection of initial components for the preparation of the mass was carried out taking into account economic and environmental factors. A mechanically activated fine fraction of the feedstock was tested as an astringent ceramic mass. To obtain it, the feedstock was subjected to blooming and mechanical activation in the aquatic environment.

III. OBJECT OF STUDY

The proposed ceramic mass contains loess like loam, natural ocher Sultan of the Uvaisky deposit, ground silicate glass in the following ratio of components, wt.%: Loess like loam - 70.0-80.0; natural ocher - 10.0-15.0; fight tare glass - 10.0-15.0. At the same time for the preparation of the ceramic mass were used loess loam containing, in wt.%: SiO_2 50.58-55.08; Al_2O_3 11.58-13.16; Fe_2O_3 3.72-5.19; CaO 12.2-14.86; MgO 2.3-3.03; Na_2O 1.44-3.88; K_2O 0.73-0.94;

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ppt 2.53-5.3. The natural ocher, selected at the Sultan deposit of the Uvaisky range of the Beruni district of the Republic of Karakalpakstan, was prepared under laboratory conditions. A macroscopic study of the sample showed the presence of inter-impurities. They were removed according to the enrichment scheme, including disintegration for removal of plant residues, the main classification (elimination) for dropping coarse sands and subsequent draining of the drain to a particle size less than 0.1 mm, and after drying the sample was crushed to a fraction of 0.063 mm. The content of iron oxides in the sample is 20%. For maintenance in the composition of the mass were used packaged glass (broken glass), ground to obtain a powder with a specific surface of 2500-3500 cm^2/g. The table shows the composition of the ceramic mass. The components are dosed in the required quantities, mixed and prepared ceramic mass with a humidity of 20-23%.

Ceramic mass was molded using plastic method, which was then subjected to drying, and burned at a temperature of 900-1050 ° C in a laboratory muffle electric furnace according to a previously calculated firing mode.

Table
The composition of the experimental ceramic mass

№	Components	Composition, mass.%		
		KC-1	KC-2	KC-3
1	Loess loam	80,0	75,0	70,0
2	Natural ocher	10,0	12,5	15,0
3	Glass container fight	10,0	12,5	15,0

To reduce the energy costs required for firing ceramic bricks and to improve certain performance properties, coke breeze was added to the composition of the brick mass as mentioned above.

Due to the combustion of coke breeze in the process of firing brick mass due to additional heat, heat is exchanged between the layers of bricks and the chemical interactions between solid phases in the lower layers are accelerated. The formation of low-melting compounds occurs at lower temperatures, which contributes to the transition of Fe2O3 to FeO due to the creation of a redox environment. It is established that the FeOl mineral, which forms in the composition of the FeO brick mass, interacts with SiO2, which contributes to the relative increase in the liquid phase, accelerates the physicochemical changes occurring in the mass at high temperature. The positive role of the addition of coke breeze and the formation of a low-melting fayalit compound as can be seen from the analysis of the data shown in the figure makes it possible to increase the mechanical strength to 50.0 MPa, decrease water absorption to 3%, increase bulk density to 4.2-4.4 kg / cm^3.

During reductive roasting in the crock, there is a process of reducing iron from its oxides, like processes occurring in a blast furnace:

Fe2O3 + ZSO = 2Fe + ZSO2 + 32 kJ / mol.

But these processes occur only at temperatures close to the temperatures of the blast furnace process, and at lower temperatures, which are created in ceramic kilns, iron oxide loses oxygen incompletely and does not completely recover iron. We receive not pure iron, but, probably, its nitrous oxide (Fe3O4), that is, scale, which is known to be black.

IV. RESEARCH RESULTS

Traditional pottery black-glazed ceramics does not require the use of glaze and has significant advantages over pottery ceramics in general, and molding, made in an injection molding method, in particular. Firstly, the second firing is not required for its manufacture, which means that the power consumption and time for its manufacture are halved; secondly, it does not require icing, the cost of which is almost a third of the price of the product; thirdly, the strength increases sharply and the sintering temperature of the shard decreases. It also has aesthetic advantages: it is now perceived at the same time as both traditional and super modern.

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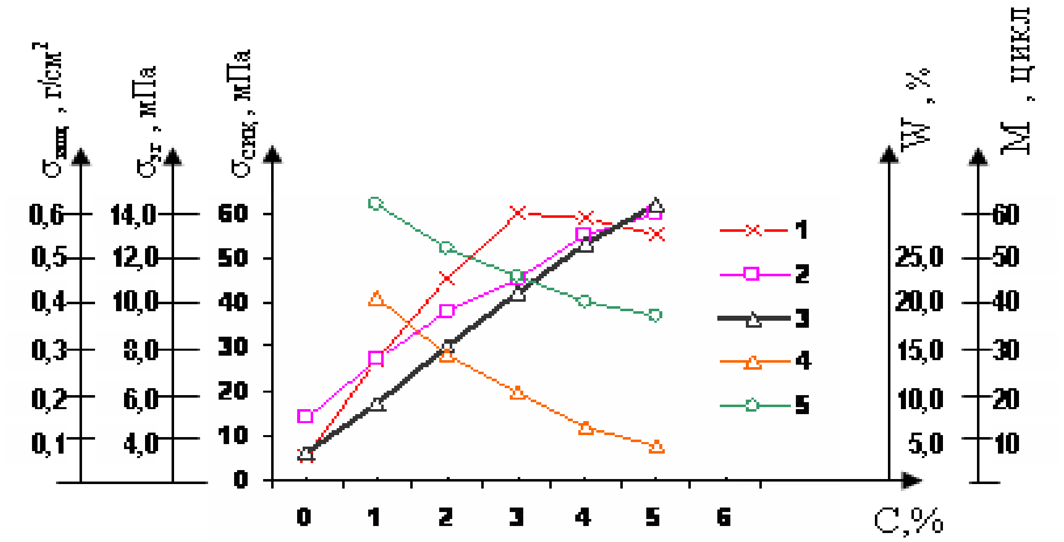
At the same time, as shown by the results of both laboratory and semi-industrial tests of optimal brick compositions, the amount of coke breeze introduced into the composition of the mass should be within 3-5%.

Thus, on the basis of off-grade raw materials in the laboratory, the possibilities of obtaining mechanically durable, salt-resistant bricks for masonry walls of industrial and individual houses in saline soils were established. Further studies have outlined field experiments in the Aral Sea region.



1- mechanical compressive strength; 2- mechanical bending strength; 3-frost resistance; 4-water absorption; 5-mechanical abrasion resistance.

Fig. Change of indicators of samples of clinker brick with the addition of coke breeze. The firing temperature is 950 ° C.

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