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EFFICIENCY OF LIGHT-WEIGHT CONCRETE WALLS FROM POROZED LEAKED ITEMS CONCRETE

POROZLANGAN OG'IRGAN BETONLARDAN YENIL BETON DEVORLARNING SAMARALIGI

ЭФФЕКТИВНОСТЬ ЛЕГКОБЕТОННЫХ СТЕН ИЗ ПОРИЗОВАННОГО КЕРАМЗИТОБЕТОНА

Goncharova N. I.,
Ph.D., Associate Professor,

Mukhamedzyanov A. R.
Assistant, Fergana Polytechnic Institute,
Fergana, Uzbekistan

Annotation
The article is devoted to ways to improve the humidity and thermal conditions of lightweight concrete walls. The research data on improving the thermal properties of porous claydite-concrete modified with the K-9 additive with heat power waste - ash are presented. An effective way to improve the moisture regime of walls using a moisture meter is recommended.

Keywords: porous expanded clay concrete, heat engineering, moisture conditions, chemical additive K-9, complex gas generator, ash, water absorption, moisture meter, improvement of properties.

1. Introduction

In accordance with the requirements of earthquake-resistant construction, large-panel external walls of civil buildings must be made of lightweight concrete. Heat loss through lightweight concrete walls is up to 30% [1]. At the same time, the problem of increasing the thermal properties of lightweight concrete of external walls is combined with the problem of creating effective concrete.

2. Discussion of Results

Various types of lightweight concrete have been developed for external walls (expanded clay concrete; claydite concrete modified with a chemical additive; claydite ash concrete; porous claydite ash concrete).

At the same time, porous expanded clay concrete makes it possible to compensate for the absence of deficient expanded clay sand, reduce the density and thermal conductivity of concrete, reduce water demand and release moisture of products, improve the cohesion and workability of the mixture, and achieve a number of other advantages[2].

Porous claydite concrete at equivalent cement consumption with ordinary claydite concrete has almost equal strength. The porous concrete mixture is less susceptible to water separation, as air bubbles seem to clog the channels through which water circulates. In this case, the intergranular space of expanded clay is filled with a porous cement paste, consisting of small closed pores [3].

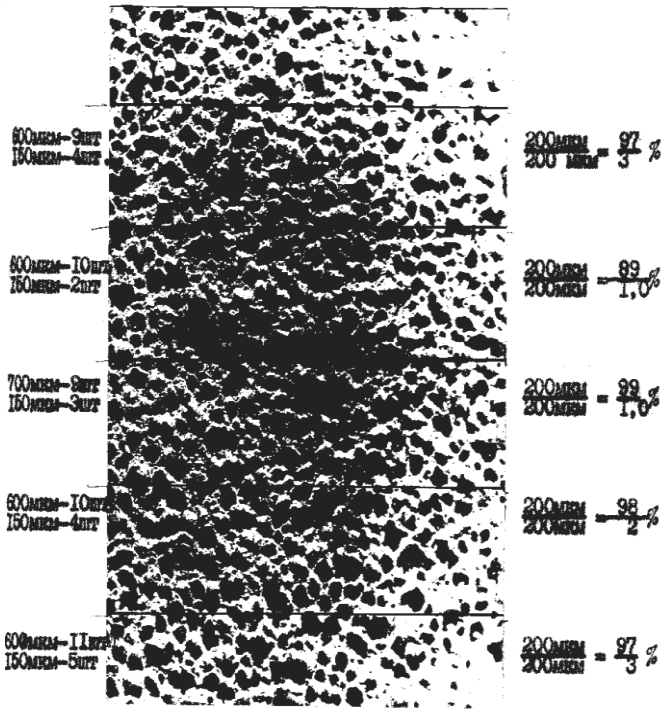
To modify the structure of cement stone, dispersions of polyvinyl acetate and its copolymers, polyacrylates are currently widely used.

The spatial system of polymer films (membranes), which is formed inside the cement stone, increases its tensile strength and serves as a microdamping element that increases wear resistance and facilitates relaxation processes in the hardening system.

As a chemical additive, a water-soluble polyfunctional acrylate action additive was used - a waste from the production of nitron fiber, called K-9 [4].

As a pore-forming additive, a complex blowing agent was used, based on aluminum powder PAK-3 (PAK-4) and the above chemical additive K-9.

The use of a complex blowing agent makes it possible to convert large air pores unevenly distributed in concrete into many small spherical air bubbles with a diameter of 50 microns or less - spheroids and obtain a fairly uniform pore grain size, which is confirmed by the data [4] and shown in Figure 1.



Scale 5:1, 1 cm - 1000 μm

Fig 1. Macro photography of porous cement-ash stone

Replacing a part of expanded clay sand in expanded clay concrete with ash (50% of the volume and a complete 100% replacement), which has an amorphous structure and a bulk density lower than the bulk density of expanded clay sand, leads to a decrease in thermal conductivity.

The combined use of ash and a polyfunctional polymer additive reduces the thermal conductivity of concrete by 7.5% [4].

At the same time, it was found that the presence of ash in the composition of expanded clay concrete leads to a change in the moisture characteristics of concrete.

Thus, the coefficient of moisture conductivity increases by approximately 70%, which indicates a more intensive penetration of moisture into the concrete [4]. This has an adverse effect on the humidity and thermal conditions of the outer walls.

In order to eliminate the above negative phenomena - reducing the moisture characteristics of lightweight concrete with ash, the most appropriate is the use of the above chemical additives of polyfunctional action.

At the same time, the polyfunctional - hydrophobic-plasticizing effect of the K-9 additive modifies the porosity of concrete, its pores and capillaries are hydrophobized.

As a result of the introduction of an acrylate polymer additive, the sorption moisture content of expanded clay concrete, expanded clay ash concrete and porous expanded clay aggregate concrete decreases by 8-10%, the moisture conductivity coefficient of expanded clay concrete decreases by 45%, expanded clay ash concrete - by 30%, porous expanded clay aggregate ash concrete - by 29-30%.

The water absorption of concrete, which depends on the porosity of porous claydite-ash concrete, has a great influence on the heat-shielding properties of the building envelope and its durability.

During the experiments, it was noted that the most intensive process of water absorption was noted for the first seven days, in subsequent days, water absorption slows down. The test results data are shown in Table 1.

Table 1 Water absorption of porous kerazito-ash concrete

№* composition	Concrete class	Compressive strength, MPa	Average density of concrete, kg/m	Water absorption by weight, %	Water absorption by volume,%
1	B5	8,1	1040	15,34	16,2
2	B7,5	10,8	1080	16,7	17,7
3	B7,5	9,8	1060	17,8	18,5
4	B7,5	10,2	1090	18,4	19,4

*** 1, 2 - concretes of optimal composition, 3, 4 - concretes of non-optimal composition.**

The thermal conductivity of porous claydite-ash concrete is determined by its density, the qualitative and quantitative composition of aggregates and binder, and the degree of binder porousness.

For the above types of lightweight concrete, the thermal conductivity was determined experimentally using the Bokk device using the stationary thermal regime method depending on humidity.

The combined use of ash, multifunctional additive K-9 and a complex gas-forming additive reduces the thermal conductivity of porous concrete by 8.1% [4].

The thermal conductivity of concrete (class B5, B7.5) with an average density of 900-1100 kg / m3 is in the range of 0.2-0.35 W / m ° C.

Analysis of research data shows that in the manufacture of porous claydite-ash concrete, one can observe the main patterns that are expressed by the alignment law of the general theory of artificial building conglomerates: the complex of extreme properties, the most favorable properties of the conglomerate, corresponds to the optimal structure [4].

Such a regular correspondence occurs under the influence of physical, physicochemical and technological factors.

A necessary indicator for predicting and studying the thermophysical properties of concrete of external walls during the operation period are the characteristics of mass transfer.

Moisture characteristics of lightweight concrete are determined on a special moisture meter, which is based on the capacitive method, based on the fact that cellular concretes as capillary-porous bodies are good dielectrics with a dielectric constant of 1-6. For water, this value is 81. According to the readings of the device, in accordance with the schedule for determining the humidity, a fixed value of the moisture content of the product is set.

In the case of obtaining increased values of humidity, its decrease should be corrected by reducing the initial moisture content of concrete and adopting such a mode of its hardening, in which two interrelated phenomena would be combined - heat-moisture hardening and drying of the material [5].

3. Conclusion

Thus, the use of an acrylate-action polymer additive K-9, a microfiller of ash - a waste of thermal power engineering in expanded clay concrete of a porous structure for the outer walls of buildings, improves their humidity and heat engineering conditions, increases durability, saves fuel and energy resources, and also improves sanitary and hygienic conditions in buildings room.

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