CEMENTLESS POROUS CONCRETE

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ABSTRACT

Characteristic of the resulting air-mechanical foam. Effect of a sealing compound type on the properties of the foam. Influence of the material composition of molding masses on the properties of alkali-silicate compositions. Effect of filler type on the properties of alkali-silicate compositions. Three tables. Characterization foam concrete on the basis of the combined filler. Characterization of the studied of alkali-silicate compositions.

1. Introduction

Cellular concrete technology combines high demands for raw components with the ability to use a wide variety of materials, including technogenic origin. As a binder for the cellular concrete used: Portland cement (non-autoclaved technology); alkali-siliceous astringent (autoclave technology). The high cost of Portland cement, the technical complexity of autoclaving necessitate the use of alternative cementless binders, which, compared to traditional allows to accelerate the production process; improve concrete porization; characterized by lower thermal conductivity; provide increased strength interporous partitions; It does not require the high temperature treatment products. Analysis of technical literature shows promising cellular concrete from alkali-silicate binders which shutteth solution alkaline component, activating curing of the powdered composition.

Purpose of work - research the effect of the material compound of the molding material on the formation of a cellular structure of alkali-silicate compositions.

The object of study - foam concrete from alkali-silicate binder based on waste heat power engineering. As technogenic filler used: ash hydroremoval thermal power plants (TPP); aluminosilicate hollow microspheres that formed of fly ash from the combustion of coal at TPP. Astringent shutteth liquid glass density of 1320 kg/m^3. For the formation of the porous structure of materials used foaming agents of various origins: synthetic - powder labeled «F1» and Protein Foam Concentrate "Unipor."

2. Effect of a sealing compound type on the properties of the foam

The resulting air-mechanical foam is characterized by the following key indicators: resistance - the ability to resist the destruction of foam for a certain time (in other words - the time during which the foam breaks down to 50% of the original volume); multiplicity - the ratio of the volume of foam to the volume of the aqueous solution from which it is derived; viscosities - the ability to foam spreading over the surface; dispersion - the degree of grinding, in bubble sizes. An important characteristic of air - mechanical foam is its electrical conductivity.

There are low-foam (20), medium (20 to 200) and high (over 200) of multiplicity. Low expansion foams are characterized by a high content in its aqueous foam and thus have a high resistance. Highly-fold foam characterized by a low content in its aqueous foam and increased content in its volume of air. At the same time high multiplicity foam are less resistant.

Foam-mass was prepared by one-step method. A suspension obtained by stirring all the ingredients in a mixer mixing was foamed. The properties of the foam and foam-mass (foam slurry) was evaluated by the multiplicity; shrinkage (reduction in volume of the foam compared to baseline, %); liquid flow (the amount of liquid separated from the foam for a predetermined time period, %); density.

Comparative characteristics of the foams at a mixing of different composition (water, liquid glass) - with synthetic foam concentrate «F1», shows that foams based on liquid glass are characterized by greater density and less resistance. The above features are due to a mixing high density (Table 1).

Table 1. Effect of a mixing type on the properties of the foam

Liquid mixing	Foam Density, kg / m^3	Multiplicity of foam	During from the time of mixing, minute	Liquid outflow, %	Foam shrinkage, %
Water	85	12	10	29	8
			30	50	23
			50	60	38
			70	67	48
Liquid glass	210	5	10	15	20
			30	48	52
			50	69	72
			70	79	82

3. Influence of the material composition of molding masses on the properties of alkali-silicate compositions

Foaming suspensions of different material composition (Table 2) shows the dependence porization from the physical properties of filler and a ratio between sealing compound and powder component (S / P). With the increase in the share of liquid glass increases the mobility of the molding mixture, grow and the average density of foam concrete.

Foaming alkali-silicate compositions depends on the type of blowing agent. When using the foam concentrate "Unipor" there is a low foaming ability of the masses, raising the average density of concrete. The molding composition with synthetic foaming agent «F1» forms a highly porous structure consisting of small closed cell size of 0.2 - 1, 0 mm.

The optimum concentration of the foaming agent depends on the type of filler. In experiments using waste heat power industry: ash hydroremoval and microspheres. Formulations based on microspheres have low bulk densities, are more sensitive to the content of the foaming component. Elevated concentrations of foaming agent promote the formation of large interconnected cells.

Alkali-silicate composition containing various excipients, characterized by a wide interval of indicators properties. To optimize the performance of porous alkali-silicate compositions studied the joint effect of fillers. The molding compositions were prepared on the basis of the combined filler.

Table 2. Effect of the material composition of molded masses on the properties of alkali-silicate compositions

Type of filler	S/P	The diameter of the spread mass, mm	The average density, kg / m^3
Ash hydroremoval	1,35	55	720
	1,10	50	500
	0,85	45	463
Microspheres	1,25	55	400
	1,00	50	375
	0,80	45	350

4. Effect of filler type on the properties of alkali-silicate compositions

The combination of materials is predetermined the need to obtain foam concrete with lower density and heightened strength values. Fillers different values of average density and particle sizes; determines the rheological properties of the compositions, affects the character of porization and hardening molding compounds.

A result of studies is revealed preferred combination of fillers, %; ash hydroremoval - 80; microsphere - 20 (Table 3).

Table 3. Effect of filler type on the properties of alkali-silicate compositions

Composition of the filler, %		Average density kg / m^3	Compressive strength (MPa) / aged, days (samples size 20x20x20 mm)		
Ash of hydroremoval	Microspheres		3	7	28
100	–	530	4,4	6,2	9,6
–	100	415	1,8	2,5	3,3
80	20	450	5,3	8,1	8,5
50	50	438	3,3	4,3	4,5

Foam concrete based the combined filler is characterized by fine, uniformly distributed porosity, low density and heightened strength values.

The investigated alkali-silicate compositions are characterized resistance to high temperatures (800 - 900 ° C), while maintaining the integrity of the structure and significant margin of safety after 10 thermal cycles.

5. Conclusion

Use as sealing compound a liquid with pronounced chemical activity and controlled density dictates the choice of blowing agents with a high foaming capacity and stability in a mixing medium.

Expanding opportunities for the optimization of the rheological properties of molding compounds ensures the formation of sustainable foam with petty closed and uniformly distributed porosity.

The availability of the raw material base, low power consumption of technological processes and high characteristics of materials demonstrate the advisability of producing cementless porous concrete.

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