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Methods For Forming the Porous Structure of Cellular Concrete

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Annotation: To create a highly porous structure of cellular concrete, gas formation methods are used; aeration foaming and dry foam mineralization; combined methods.

Keywords. *Vibro-vacuum, PAP-1, PAP-2, hydrophobicity, sulfanol, suspension, blowing agents.*

Introduction

To create a highly porous structure of cellular concrete, the following methods are used: gas generation, foaming, aeration and dry foam mineralization, vibro-vacuum, the method of saturating the molding mass with air under pressure, combined methods. Gas formation method The essence of the method lies in the fact that gases released during the interaction of gas-forming agents introduced into the molding mass with each other, with cement adhesive minerals or during their decomposition in an alkaline medium uniformly porous the molding sand having a certain viscosity and setting time. At the same time, the main conditions for obtaining a high-quality porous structure of concretes are the presence of a high gas-holding capacity in the molding mass and the combination of the processes of the end of the expansion of the mixture and the beginning of its setting in order to fix the resulting material structure. Aluminum and zinc powder, hydrogen peroxide, ferrosilicon together with powder, silicon-aluminate alloy or combinations thereof, and other substances can be used as gas generators. To obtain cellular concretes, aluminum powder PAP-1 and PAP-2 (aluminum pigment powder) are mainly used as a blowing agent. It should contain 87...98% active aluminum, have a high specific surface area (600...850 m7kg). Powder particles have the form of petals with a diameter of 20...50 microns and a thickness of 1...3 microns, the surface of which is covered with a thin layer of paraffin or stearin. This prevents the formation of a homogeneous aqueous aluminum suspension. Therefore, before use, the powder must be calcined in ovens at a temperature equal to or less than +200 ° C, or used in conjunction with surfactants. When calcined, the paraffin film burns out, and

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therefore the powder acquires the ability to form a homogeneous suspension with water. But at the same time, part of the aluminum is oxidized, which reduces the chemical activity of the powder by 10 ... 15%. In addition, when calcined, the powder may ignite, and therefore it should be calcined slowly and carefully. The total duration of the process is 8 hours, and keeping at the maximum temperature - 4...5 hours. More convenient and technologically advanced is the method of obtaining a homogeneous aqueous aluminum suspension with the addition of surfactants (surfactants) to the composition up to 5% by weight of the powder. Surfactant reduces the surface tension of water, which contributes to good wetting of powder particles and the formation of a homogeneous suspension.

An effective technique is to obtain dry mixtures and pastes based on aluminum powder and surfactant powder, the use of which greatly simplifies the process of preparing an aluminum suspension, and most importantly, improves working conditions and safety. It has been established that the best results are achieved in the case of using an aluminum blowing agent in the form of pastes. The determination of the listed indicators is provided and carried out in accordance with the GSN 420895 standard (Czech Republic). The use of AIBO 542 aluminum paste as a blowing agent made it possible to reduce the average density of cellular concrete from 550 to 525 kg/m3 without reducing the strength characteristics. It is more expedient to use aluminum paste, which is obtained by mixing aluminum powder with an aqueous solution, for example, sulfanol (1 liter of solution contains 25 g of sulfanol) at a ratio of 1:1. When the powder interacts with Ca (OH) 2, which is formed during the interaction of cement silicates with water or is specially introduced into the molding mass, hydrogen is formed: 2A1 + 3Ca(OH)2 + 6H20 = 3CaO • A1203 • 6H20 + 3H21.

The intensity of the reaction depends on the degree of dispersion of the powder and the purity of the surface of its particles, temperature and alkalinity of the medium (35...45°C). The larger the specific surface of the powder, the cleaner the surface of its particles, the higher the temperature of the mixture (within certain limits), the alkalinity of the medium, the more complete the reaction proceeds and the more gas is released. The rate of gas evolution can be slowed down (for example, by lowering the temperature of the mixture or introducing strong oxidizing agents into it, for example, nitric acid) and increased by introducing NaOH (0.5% C), ground activated carbon, ferrosilicon, or mixture vibration into the mass. NaOH also interacts with aluminum powder and an additional amount of hydrogen is released: 2A1 + 6NaOH + pH20 = 3Na20 • A1203 • pH20 + Zh2 \. At. vibrating" the mixture, there is a continuous renewal of the contact surface of the reactants, which contributes to the acceleration of the process of gas evolution. It is possible to use hydrogen peroxide (perhydrol) as a gas-forming agent, which releases oxygen in an alkaline environment and when heated: 2H202 - 2H20 + 02\. However, this gas-forming agent is practically not used due to the variability of properties and the danger of working with it.

Ferrosilicon in the composition of the intumescent substance is called a gas-forming agent of the second action. The total consumption of the complex blowing agent is 0.25...0.86 kg per 1 m3 of concrete with a density of 500; 800 kg/m. When gassing with the use of aluminum powder, a porous structure of concrete with a large volume of interconnected pores (up to 50%) is obtained, which is heterogeneous in height, and a certain technological complexity is observed when using powder for the preparation of aerated concrete (a special procedure for introducing powder into the mixture when

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it is mixed, the mixture must , have a strictly required temperature, sufficient alkalinity, the complexity of control - the process of gas evolution after the introduction of powder into the mixture). Powder as a gas-forming agent: has a number of significant drawbacks; hydrophobicity, high degree of dusting; explosiveness, unsatisfactory sanitary and hygienic working conditions. Manufacturers of powder: metallurgy carry out, control of such indicators as hiding power on water, composition, amount of impurities, amount of fats, which is decisive for. paint and varnish factories, but they do not carry out control and analysis of the most important indicators for producers of cellular concrete - the kinetics of gas evolution, the content of active aluminum. Long-term practice has shown the low efficiency of the selection of the gas-forming agent based on the existing passport data, which is clearly not enough. Thus, domestic manufacturers of cellular concrete began to form requirements for a new type of raw material - a specialized gas generator. A program was adopted for the development and implementation of a new line of domestic gas generators of aluminum paste grades. Characteristics of aluminum pastes for the production of aerated concrete.

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