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Improving Performance Characteristics of Construction Materials Manufactured by Pressing Technology

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Abstract

The development of the construction industry has necessitated the creation of efficient high-quality materials, the use of which is cost efficient and can reduce energy costs and consumption of raw materials. The potential of the Portland cement should be utilized to the fullest, because concrete structures and concrete products are the foundation of modern Q. The promising direction of solving this problem in the production of the piece of wall materials is to develop technologies using high compression pressures.

The article discusses the experimental studies of the substructure formation of building materials of high-filled dispersion, as well as the influence of technological factors on the dynamics of construction materials properties (for example, protecting and supporting structures) during long-term operational impacts.

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Keywords: concrete; strength; water absorption; stones; concrete masonry products; cement; compacting pressure.

1. Introduction

For high-strength cement-based materials in recent decades it has been established entirely new methods and technologies.

In the production of building materials and pressing vibrocompression powder weights occupy an important place among the technological methods of producing finished products.

The manufacturing techniques of traditional wall materials obtained by the method; semi-dry molding; followed by baking, steaming or by autoclaving, associated with high energy consumption, using the compression pressure of 10-30 MPa.

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Using hyper-technology in the production of products manufactured without firing a promising solution to produce wall, road and facing materials [1].

Submissions received on these technologies differ from traditional following features:

1. The lower power consumption, since they do not manufacture. It requires heat and heat and humidity treatment;
2. The lower consumption of binder;
3. more extensive resource base, allowing the use of a readily available local natural raw materials, industrial wastes and by-products;

When pressing powders main process parameters are pressing pressure, humidity and molding sand particle size distribution of aggregates mixture of fine filler and binder. [1, 2, 3]

High-strength cement stone can be obtained by creating a uniform volume of high-density structure, which is achieved by compression, the selection of a rational size distribution, reduction of the W / C, the removal of the conditions for the emergence of irregularities and structural defects [4]. Pressing cement binding materials allows to obtain structures with maximally dense particle packing and low porosity. During hydration of these systems is formed a tight, substantially free of calcium hydroxide, cement rock compressive strength reaches 350-400MPa. [5]

Also, according to an early study [6], especially the structuring of the powder mass in the process of molding flow through a series of successive stages. At the initial moment of the particle applying pressure move in the direction of the pressure vector, filling large pores and destroying bridges and arches, arising freely poured powder. The water acts as a lubricant, reducing friction between the particles and taking part in transmitting the pressure on the volume of the system. Deformation of the particles hardly occurs and reaches an equilibrium position of the structural elements of the material, the packing density is significantly increased relative to the initial state. But at the same density and the area of contact between the particles varies slightly, and the composite strength is low (prepressing stage). In the further application of pressure (compaction stage) reaches its maximum compaction mixture, characterized by a critical density, and the molding pressure for a given moisture content is critical. With increasing force pressing system "water - solid particles - entrapped air" behaves as an elastic body, and after removal of the load, it expands. The water, located between the solids of the moldable mixture, and the film weakening point contacts between the particles, which leads to a reduction in strength. This mechanism explains the presence of structure optimal pressure dispersion systems, working as an elastic body. [7-11]. When further increasing the compaction pressure (above 100 MPa) the powder particles starts deformation first elastic and then plastic with a change in the value of the contact surface. At the same time changing particle size of the mixture components. This increase in the proportion of plastic deformation and crushing of aggregate mass of the particles (which leads to the activation of its surface) and explain the observed increase in strength while the samples with increasing compaction pressure of more than 100 MPa. [12-17].

The mechanism of structure formation of disperse systems under very high pressure is interesting in itself, but most of the technologies for the production of extruded materials are focused on existing equipment, ensuring the achievement of optimal pressure range.

How can we improve the strength characteristics of the materials in this case?

Previously we have considered regularity of structure formation of pressed cement compositions according to the type and amount of mineral admixtures, surface-active agents and accelerator for hardening [6].

The purpose of this project is to study regularity of structure formation of pressed cement compositions depending on technological factors, as well as physical-mechanical properties of concrete including long term operational impacts.

The following materials were used in the experimental researches. Binding material is Portland cement with mineral admixture CEM II/B-III 32,5H produced by Dyckerhoff Korkino Cement, which satisfies the requirements of GOST 1108-2003 3 "Standard cements. Technical specifications" with actual mineral clinker composition: C_3S = 65%, β-C_2S = 13%, C_3A = 7%, C_4AF = 14%.

Fine aggregate – quartz sand according to GOST 8637 with a fineness modulus of 2,37.