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Article 1

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Contact strength of C-S-H cement phase with additives

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Keyword: cement phase C-S-H, contact strength, additives, high alumina slag, portlandite, calcium aluminates

Abstract

The study of the contact-condensation properties of building materials is based on the possibility of forming a durable water-resistant artificial stone by a convergence of particulates, for example, in the pressing process. It allows to obtain in the shortest time possible a durable material based on waste and by-products of the industry, for example, nepheline sludge, concrete scrap, the main phase of which are hydrated silicate minerals – C–S–H cement phase. Structural-chemical and thermodynamic analyzes of the structure of C–S–H phase nanoparticles show that for the formation of silicon-oxygen chains on the portlandite surfaces of these particles, a combination of silicon-oxygen diortho groups with bridging alumina-oxygen tetrahedra is advantageous. That is why it is advisable to study the contact hardening of the C–S–H phase with various additives including calcium aluminates. The directional formation of silicon-alumo-oxygen chains and the modification of the basicity of the C–S–H phase due to the use of aluminate and silicate additives is a scientific novelty of the work. The contact hardening of the C–S–H cement phase with additions of portlandite, nano-silica, and nano-alumina was carried out in this work. The C–S–H cement phase was synthesized from calcium oxide, silica, and water at a temperature of no higher than 100 °C. The experimental part contains a study of the dependences of the compressive strength of a stone from C–S–H on the type of additives, hardening time and pressing pressure. It is shown that the addition of high-alumina slag significantly increases the compressive strength of the pressed stone, which is provided by the formation of contact-active C–S–H and alumina gel $Al(OH)_3$.

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Article 2

Gol'tsman B. M., Yatsenko E. A., Komunzhieva N. Y., Gerashchenko V. S.
Synthesis of foam glass based on natural silica raw material
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Keywords: foamglass, foaming, raw material, silica rock, porous structure, thermal treatment

Abstract

This article discusses the possibility of using sedimentary rock as the main component in the synthesis of foamglass. For this purpose, prototypes were synthesized based on the flask of the Botchinsky field, which has a fine-grained structure and a polymineral composition. The foamglass was synthesized using a one-stage powder technology; the samples were fired in the temperature range of 800-900 °C for 20 minutes, followed by annealing for 2–3 minutes. During the experiment, several series of samples with different charge compositions were developed, in particular, sodium hydroxide and sodium fluoride were added to some to intensify the foaming process and increase the sinterability of the resulting material. As a result of studying the synthesis of foamglass at different temperature conditions, it was found that: a mixture of additives reduced the melting point of the sample to 850 °C; the addition of NaF significantly increased the density of the samples, but did not affect the porosity; the presence of NaOH in the mixture made it possible to obtain a sintered sample with a density below 1000 kg/m^3. The conclusion was made about the possible potential use of synthesized foamglass based on flask in production, subject to further research.

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Article 3

Tararushkin E. V.

Evaluation of the correlation dependence of average density and strength on compression of portland cement

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Keywords: Portland cement, strength, density, correlation coefficients, dependent random variables, copula

Abstract

The results of evaluating the correlation between the density and compressive strength of Portland cement at the age of 28 days with different values of the water-cement ratio (W/C = 0.3, 0.4, and 0.5) are presented. Correlation dependencies are determined using linear coefficients of Pearson, Spearman and Kendall. It is shown that with an increase in the water-cement ratio, the correlation between the density and compressive strength becomes stronger. It was also found that the most correlated experimental data (W/C = 0.5) can be considered dependent random variables. Through information criteria AIC and BIC, Clayton's copula was selected for this experimental data. Use the copula allows generating the required number of test results of dependent random variables in probabilistic modeling.

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Article 4

Vasilyeva A. A., Pavlova M. S.

Production of continuous basalt fiber based on basalt of the Vasilievsky field

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Keywords: : mineral composition, basalt, crystallization, immersion analysis, x-ray spectral analysis, acid-base indicators of chemical composition, petrographic study of structural and mineral composition

Abstract

The technology of obtaining continuous silicate fibers from basalt melts consists in the selection of raw materials of the required composition, its melting, homogenization of the resulting melt, usually in a platinum vessel, and pulling a viscous cooling silicate mass at a certain speed and temperature from the die holes of a given diameter. Thus, the main purpose of the experimental studies was to assess the possibility of obtaining continuous fibers from the raw materials of the Vasilievsky field of Yakutia, for their use as reinforcing elements of polymer composite materials.

Preliminary assessment of the suitability of basalts for the production of certain types of fibers is made using various indicators of acid-base characteristics of melts: acidity modulus, anion structure coefficient, pyroxene modulus, viscosity modulus, etc.

In the result of complex laboratory and experimental studies, conclusions were drawn and recommendations made for the appropriateness of Vasilievsky basalt deposits as petrurgical raw materials for the production of continuous fibers.

The results of studies of chemical and mineralogical composition of potentially suitable petrovicskero Vasil raw material deposits for production of continuous basalt fiber and composite materials on its basis. Methods of x-ray spectral and petrographic analyses were used. Studies have shown the possibility of obtaining continuous basalt-based fibers dolerite Vasilievsky deposits, as its composition and the main characteristics comply with the requirements of petrurgical raw materials, the modulus of viscosity, peroxisome composition, presence of phase transformations, etc.

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Article 5

Kondrashenko V. I., Titov S. P.

Activation of cement in the mill of the vortex type.
Part 1. Properties of vortex mill activated cement

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Keywords: activation, vortex-type mill, Portland cement fineness, normal density of cement paste, water-cement ratio, compressive and tensile strength in bending

Abstract

A comparative analysis of the properties of cement, cement-sand mortar and cement-sand stone, prepared on Portland cement before and after its processing in a vortex-type mill (fineness of Portland cement grinding, normal density of cement dough, water-cement ratio of normally thick cement dough, timing setting of cement-sand mortar, strength characteristics of cement-sand stone). An increase in the fineness of cement grinding during its processing in a vortex mill was noted, which did not lead to an increase in the water-cement ratio of equal-moving mortar mixtures with a significant increase in compressive strength (up to 49%) and tensile bending (up to 26%) of cement-sand stone, obtained on Portland cement activated in a vortex-type mill. A hypothesis has been put forward for the modification of the shape of cement particles from angular to more rounded.

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Article 6

Rakhimova N. R., Rakhimov R. Z., Bikmukhametov A. R., Morozov V. P.

Influence of the temperature of thermal activation of polymineral clays on the strength and composition of alkali-activated cements based on them

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Keywords: clay, cement, alkaline activation, heat treatment

Abstract

Currently, the world has significantly increased the amount of research and development of the use of clay for the production of alkali-activated cements and as mineral additives in Portland cement. At the same time, the compositions of most varieties of polymineral clays activated at different temperatures, their influence on the composition of clays and alkali-activated cements based on them have not been studied sufficiently. The article is devoted to the study of the clay compositions of 3 varieties of polymineral clays and compositions, and the properties of the cement stone activated with alkali.

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Article 7

Sarkisov Yu. S.
New patterns of distribution of chemical elements (enoids) with Z> 118
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Keywords: enoid, quantum numbers of the first, second, third generation, classification of quantum numbers, periodicity, laws of quantum mechanics, Klechkovsky rules, Schrödinger equation

Abstract

This article discusses the new patterns of distribution of chemical elements in the table D.I. Mendeleev with serial numbers z> 118. It is shown here that the filling of electronic shells for enoids fully complies with the laws of quantum mechanics and corresponds to the Pauli principle and the rules of Gund and Klechkovsky. Revealed new patterns associated with the appearance of quantum numbers of different generations. The article discusses the characteristics of quantum numbers of different generations and their relationship with each other.

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Article 8

Rakhimov R. Z., Rakhimova N. R.
At scientific meetings. XV International Congress on the Chemistry of Cement. Separate reports and current issues
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