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Article 1

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Silicon structured hydroxyapatite cements for bone plastic surgery

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Keywords: silicon structured calcium phosphates, tricalcium phosphate, hydroxyapatite, hydroxyapatite cement, porosity, durability

Abstract

Silicon structured hydroxyapatite cements are obtained on the basis of silicon structured α-tricalcium phosphates having the increased values of solubility. Influence of content of silicon in structure silicon structured α-tricalcium phosphates and concentration of tempering water – sodium hydrophosphate on chemical and physicomechanical properties of the received cements is investigated. Silicon structured hydroxyapatite cements for application in bone plastic surgery are optimized.

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Article 2

Molchan N. V., Krivoborodov Yu. R., Fertikov V. I.

Interatomic interactions in binary compounds of calcium

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Keywords: concentration of electrons, density, structure

Abstract

Chemical interactions and phase transformations are traditionally characterized by thermodynamic indicators and state diagram. Transformations of substances are followed by thermal effects and changes of volume. Density, important characteristic of substances, is result of two indicators: 1) the weight which is concentrated in atomic nuclei and 2) the volume which is formed by electron shells. Chemical processes are the reactions proceeding with formation of new connections. The act of chemical interaction consists in formation of new electronic (molecular) orbitals. The chemical bond between atoms is caused by overshoot of electronic clouds. Transformations of substances and formation of new structure is defined by interaction of electron shells of atoms and molecules. Thermal processes are

rather in detail considered in numerous works on chemical thermodynamics, and information on changes of volumes is not enough.

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Article 3

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Effect of thin-dispersible slag on cement properties with mineral additives

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Keywords: fine-milled slag, granulometric composition, cement stone, strength, porosity, degree of hydration

Abstract

The method of introduction of fine-milled blast-furnace granulated slag (DGS) into the cement composition as a result of dry mixing of the material with the additive is considered. Fine-milled slag was obtained in a vortex jet mill with the upper limit of grinding to 1 and 20 microns (slag 1, slag 2, respectively). The granulometric composition of slag 1 and 2 is determined. It was found that the predominant size in slag 1 is 0.5–1 μm; in slag 2 – 1–7 mcm. Fine-milled slag (slag 1, slag 2) was introduced into the cement, containing in its composition as an active mineral additive 15% DGS (particle size – 40-60 microns), in an amount of 1, 3, 5% of the cement content. The aim of the study was to study the effect of the addition of fine slag on the construction, physical, mechanical, structural characteristics of cement with mineral additives. The terms of setting were studied, the normal density of the cement paste with the addition of fine slag was determined. Dependences of strength and porosity of cement stone on the time of hydration of samples are constructed. Strength of cements was determined by the national standard GOST 30744-2001. The porosity of cement stone was determined by the method of saturation of samples with inert liquid. It is established that the introduction of 3–5% slag 1 and 1–3% slag 2 provide increased strength of the cement stone during the first day of hardening on average, 37 to 44%; in the branded age of26–30 %, reduction of porosity by 17–28%. It is shown that the introduction of a fine-milled slag additive compacts and strengthens the structure of cement stone. It was found that grinding DGS to a size of 1 μm (slag 1) is impractical, because. the obtained results are comparable with the results of the introduction of slag 2 into the cement composition.

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Article 4

Aung Htut Thu, Zakharov A.I.

The heat-insulating material on the silicate sheaf received on the basis of waste of rice processing

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Keywords: thermal insulation, liquid glass, rice peel

Abstract

In this work use of waste of agriculture (a rice peel) as raw materials for production of heat-insulating materials is considered that provides decrease in energy consumption, increase in profitability and environmental friendliness of production.

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Article 5

Vasilkov O. O., Barinova O. P., Kirsanova S. V., Elfimov A. B., Marnautov N. A.
Influence of temperature on synthesis by spontaneous crystallization of nickel chromite
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Keywords: nickel chromite, chromonickel spinel, infrared ranges, morphology of crystals, simple forms of an facet octahedron and tetragontrioctahedron

Abstract
Influence of temperature on synthesis process by spontaneous crystallization of nickel chromite $NiCr_2O_4$ with structure of spinel is investigated. Steady formation of chromonickel spinel in a temperature interval of 900–1050 °C is established. X-ray diffraction characteristics (parameters of an elementary cell, density), morphological features, particle size distribution of chromite of nickel are defined.

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