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Article 1

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Development of production technology of artificial porous aggregate based on cullet and ash and slag waste

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Keyword: artificial porous aggregate, ash and slag waste, blowing agent, cullet, slag, ash, cellular structure

Abstract

The article presents the results of laboratory research on the possibility of a partial replacement of cullet for ash and slag waste from thermal power plants (fly ash, slag and ash-and-slag mixture) in order to produce artificial porous aggregate. The influence of the type of pore-forming agent, the amount of ash and slag waste in the composition and temperature-time regimes of sintering the mixture on the final properties of the material is investigated. Photographs of the cellular structure of the obtained laboratory samples are presented.

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Article 2

Rakhimbayev S. M., Rakhimbayev I. Sh. **Thermodynamic analysis of the hydration of belite**

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Keywords: Gibbs energy, enthalpy, activity, ion concentration, heat release, Born - Haber cycle

Abstract

The values of isobaric-isothermal potential (ΔG_{298}^0) of enthalpy (ΔH_{298}^0) of hydrosilicate composition $3\text{CaO}\cdot 2\text{SiO}_2\cdot 3\text{H}_2\text{O}$ given in reference literature ($\Delta G_{298}^0 = -1053$ kcal/mol) are considered. The correct values of ΔG_{298}^0 and ΔH_{298}^0 are proposed on the basis of the calculated solubility value of $3\text{CaO}\cdot 2\text{SiO}_2\cdot 3\text{H}_2\text{O}$ for CaO equal to 0.7 g/l. These values are verified by comparing the solubility of calcium hydrosilicates in water and by heat release during hydration of belite.

Thermodynamic calculations are carried out using the values of ΔG_{298}^0 and ΔH_{298}^0 proposed by the authors of the processes of hydration of belite. It is shown that hydration of belite is possible with education as silicate hydrate of $1.5 \text{CaO}\cdot \text{SiO}_2\cdot 1,5\text{H}_2\text{O}$ and $2\text{CaO}\cdot \text{SiO}_2\cdot 2\text{H}_2\text{O}$. The first of them has an equilibrium solubility of CaO equal to 0.7 g/l, and the second – 0.9 g/l, so the first is presumably formed in a mixture of belite with 10 - 30% of active mineral additives, and the second – in their absence. With an excess of calcium hydroxide in the system of $1.5 \text{CaO}\cdot \text{SiO}_2\cdot 1,5\text{H}_2\text{O}$ is unstable and turns into $2\text{CaO}\cdot \text{SiO}_2\cdot 2\text{H}_2\text{O}$, which occurs in a stone with a normal water content ($V/T = 0.2 - 0.28$).

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Article 3

Shevtsov D. S., Zartsyn I. D., Elshin M. A. **Features of the repair of reinforced concrete structures at chemical facilities**

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Keywords: concrete repair, adhesion, carbonization, dolomite, ettringite

Abstract

The peculiarity of the operation of chemical industry facilities is the variety of potential impacts on the structures of an insignificant length. The necessity of carrying out a complex inspection of reinforced concrete structures at the chemical industry enterprises is exemplified by a specific object under

reconstruction. The use of high-quality repair compositions is not a guarantee of obtaining defect-free revetments. The area of secondary defects with respect to the area under repair is assessed as significant. Peeling and cracks in the repair composition are local, which is confirmed by the results of adhesion control. The applicability of analytical (pH-metry) and physical methods (IR-Fourier spectroscopy, X-ray fluorescence analysis) of research for obtaining important information to identify the causes of defects in the repair of reinforced concrete structures is demonstrated. The probable causes of peeling and cracks in the repair composition: insufficient surface preparation due to incorrectly determined depth of carbonation, potentially high reactivity of coarse aggregate with a high content of dolomite mineral, as well as the formation of ettringite at the interface of the repair composition and the surface under repair accompanied by an increase in volume. Restoration of adhesion at the sections without the concrete layer cracking can be achieved by using the technology of injection of low-viscosity compositions.

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Article 4

Samchenko S. V., Aleksandrova O. V., Zaitseva A. A.
Influence of liquid glass density on the properties of aerated concrete

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Keywords: cullet and liquid glass, density of liquid, aerated concrete, density of aerated concrete, compressive strength, water absorption, softening coefficient

Abstract

The possibility of using technical glass bout with liquid glass to produce aerated concrete using low-energy technology was considered. The optimum density of liquid glass was established upon receipt of the aerated concrete mix, which should be at least 1.23 and not more than 1.35 g/cm³. The technical characteristics of aerated concrete based on cullet and liquid glass obtained in this work are determined. Thermal conductivity of aerated concrete with its density of 150-400 kg/m³ is 0.06 W/moC. The resulting aerated concrete is recommended for thermal insulation of pipelines both during construction and during their repair. The use of an unsorted technical glass bout as part of aerated concrete will allow the disposal of non-decomposing industrial wastes, which makes it possible to speak about the development of environmental technology, while reducing the cost of producing effective heat-insulating materials about its economic efficiency.

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Article 5

Molchan N. V., Krivoborodov Yu. R., Fertikov V. I.
Interatomic interactions in binary aluminum compounds

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Keywords: electron concentration, density, structure

Abstract

Physical and chemical properties are determined by the number and location of nuclei and electrons. The transformation of substances is accompanied by thermal effects and changes in the volume, which is formed by the electron shells of atoms. The electron shells change their shape and volume depending on the environment of their other atoms. Thermal processes are described in detail in numerous papers on chemical thermodynamics, and information on volume changes is not enough. Presents calculations showing the interaction of aluminum with other atoms.

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Article 6

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General and special «digital» prerequisites for the creation of scientific-methodical and system-technical principles of the strategy of cement production development

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Keywords: digital economy, digital technologies, digitalization, stage of development, cement production

Abstract

Considered and analyzed the main stages of formation and development of the digital economy and the main players in the market of digital services with their rating. Individual enterprises that have carried out digital transformation of the functional structure using digital technologies are announced. This is a real and effective tool to improve the technical and economic efficiency of production and improve the competitiveness of products.

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Article 7

Zorin D. A.

Grindability of expandable cement additives

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Keywords: expansive cement, grindability, alumina slag, sulfoaluminate clinker, sulfoferrite clinker, sulfoalumoferrite clinker

Abstract

The most popular building material, including on transport facilities, is cement. Cement production is associated with the electricity costs. The biggest cost item is the consumption for the cement clinker grinding. It is known that disperse characteristics of cements, such as fineness of grinding, specific surface, coarseness of grading, largely determine their hydraulic properties, and for expanding cements - the deformation ones. In the paper, the issues of electric power consumption were considered when grinding extender expanders: aluminous slag, sulfoaluminate, sulfoferrite and sulfoalumoferrite clinkers.

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