Thematic Section: Research into New Technologies. **Full Paper**
Subsection: Inorganic Chemistry. *Reference Object Identifier* – ROI: jbc-02/16-47-8-93
Publication is available for discussion in the framework of the on-line Internet conference "*Butlerov readings*".
http://butlerov.com/readings/
Submitted on November 18, 2016.

Optimization of charge composition for the production of building ceramics using galvanic sludge and glass waste

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Keywords*:* building ceramic, galvanic sludge, glass waste, compression strength, environmental safety.

Abstract

In this paper presents the results of mathematical modeling and optimization of charge composition for the production of building ceramics with high compression strength on the basis of low-plasticity clay of the Vladimir region with the addition of local wastes: galvanic sludge and sheet glass waste. Additionally, the composition of the batch was injected boric acid to guarantee the environmental safety of the resulting ceramics. Samples of ceramics for research were obtained with the molding moisture of the charge 8 wt. %, a specific pressing pressure of 15 MPa and a firing temperature of 1050 ^{o}C. In addition to compression strength in the paper takes was identify by the density, porosity, water absorption and frost resistance of ceramics based on the studied composition. All physico-mechanical properties of ceramics samples were identifying according to standard building materials methods. Environmental safety of the test material was assessed using a methodology for determining mortality Daphnia species *Daphnia magna Straus* under the action of toxic substances present in the aqueous extract of the studied samples after 96 hours. Optimization of charge composition was conducted using the method of mathematical modeling for the variation of three factors at three levels using a Box-Behnken. In this paper presents the obtained regression equations and response surface for the studied properties of ceramics, for which it was found that the introduction of the composition of the batch on the basis of low-plasticity clay 32 wt. % glass waste, 5 wt. % of galvanic sludge and 2.5 wt. % boric acid can be obtained environmentally friendly ceramic material with a density of 1707.3 kg/m^3, compression strength of 30.3 MPa, the porosity of 2.6%, water absorption of 2.7% and frost resistance of 53 cycle. The application of this composition on the one hand will allow to expand the raw material base of the Vladimir region, and on the other will contribute to the solution to the region's immediate problems of disposal of toxic galvanic sludge and heavytonnage glass waste.

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