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Construction of the crystallization temperature diagram for slags of the $CaO-SiO_2-B_2O_3$ system containing 15% Al_2O_3 and 8% MgO

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Abstract

In the work the influence of the chemical composition on the crystallization temperature of slags of the $CaO-SiO_2-B_2O_3$ system containing 15% Al_2O_3 and 8% MgO (hereinafter in % wt.) is studied using the simplex-lattice method of an experiment design. This experiment design method allows to obtain mathematical models that describe the dependence of a property on a composition in the form of a continuous function. The local simplex presented by two concentration triangles $CaO-SiO_2-B_2O_3$ was investigated. The experiment was planned in the coordinates of pseudo-components. According to the theory of Frenkel viscous flow the temperature of the onset of slag crystallization of the examined oxide system was determined graphically from the point of fracture of viscosity polyterms constructed in the coordinates ln η–1/T. To describe the dependence of the crystallization temperature on the composition of the slag of the oxide system under study, a mathematical model in the form of a third-degree polynomial was chosen. The results of mathematical modeling formed the basis for constructing the composition–property diagram, the analysis of which made it possible to quantify the influence of the chemical composition of slag on the crystallization temperature of the oxide system under study. It is shown that the addition of boron oxide to slag significantly expands the range of slag composition with a low crystallization temperature. For example, slags with a basicity of 2-3 are characterized by a crystallization temperature varying from 1350 °C (4-6% B_2O_3 content) to 1450 °C (1-2% B_2O_3 content). The slags shifted into the area of increased to 3-4 basicity maintain a fairly low crystallization temperature that varies from 1400 to 1475 °C at 1-6% B_2O_3 content. The temperature of slag crystallization in the area of increased up to 4-5 basicity practically doesn't exceed 1475 °C at a reduced to 1-2% B_2O_3 content.

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