

Experimental studies of periclase-carbon refractories solubility in the slags of the system $\text{CaO-SiO}_2\text{-B}_2\text{O}_3\text{-Al}_2\text{O}_3$

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Abstract

The study of the effect of boron oxide and the basicity of the $\text{CaO-SiO}_2\text{-B}_2\text{O}_3$ system slags containing 15% Al_2O_3 on the solubility of periclase-carbon refractories was carried out using a simplex – lattice method of experiment planning, which allows to construct mathematical models describing the dependence of the property being studied on the composition as a continuous function. Synthetic slags, corresponding in composition to the vertices of the simplex under study, were smelted in graphite crucibles from previously calcined oxides of analytical grade. Experimental compositions of slags corresponding to the remaining points of the local simplex plan were obtained by counter-mixing slag to the tops of the simplex. Using experimental data, we constructed mathematical models that adequately describe the effect of slag composition on wear degree of refractory sample. The graphic image of mathematical modeling results is represented by the composition diagram - the solubility of the refractory sample. An analysis of the experimental data in the diagram made it possible to obtain new data and quantify the effect of boron oxide and the basicity of the $\text{CaO-SiO}_2\text{-B}_2\text{O}_3$ system slags, containing 15% Al_2O_3 on the solubility of periclase-carbon refractories. It is shown that slags formed in the basicity 2-3 range, containing 4-6% B_2O_3 , are characterized by a rather high aggressive effect on periclase-carbon refractory. The wear degree of the refractory sample varies from 25 to 40%. A decrease in the B_2O_3 content in the slag to 14% with the same basicity is accompanied by a reduction to 10-30% aggressive effect of the slag on the periclase-carbon refractory. Slags with basicity 3-4, not containing magnesium oxide, are characterized at 1-4% B_2O_3 with a relatively low aggressive effect on periclase-carbon refractory. The wear degree of periclase-carbon refractory varies within 8-12% and practically does not reach 15%. Displacement of slags in the area increased to 5 basicity does not lead to a significant reduction in the aggressive impact on the refractory. The wear degree of the refractory sample varies in the range of 6-10% with a content of 1-4% B_2O_3 and increases to 15% with 5-6% B_2O_3 . It was noted that in order to ensure a lower aggressive effect of recommended composition slags, it is advisable to form them in the region of MgO saturation. The formation of such slags provides low viscosity and preservation of high refining properties.

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