

## PERICLASE-SPINEL REFRACTORIES FOR ROTARY KILNS

Borysenko O.M.<sup>1</sup>, Logvinkov S.M.<sup>2</sup>, Shabanova H.M.<sup>1</sup>,

Ishchenko A.M.<sup>1</sup>, Levchenko M.Yu.<sup>1</sup>

<sup>1</sup>*National Technical University «Kharkiv Polytechnic Institute», Kharkiv*

<sup>2</sup>*Simon Kuznets Kharkiv National University of Economics, Kharkiv*

The production of refractories for the cement industry has made significant progress in recent decades. Rotary kilns are the most common in the cement industry, where the operation of refractory masonry takes place under very difficult conditions. In addition to the chemical interaction with the roasting product, the lining is subject to temperature stress caused by temperature difference, as well as to mechanical stress from the furnace body pressure. The durability of the rotary furnace lining depends on the intensity of the loads (chemical, thermal, mechanical) acting on the refractory material of the lining.

The main requirements for refractory products for rotary kiln lining of cement clinker are: high density and strength, low porosity and gas permeability, increased abrasion resistance, low thermal conductivity, high corrosion resistance and ability to form a protective layer.

Today, the main goal of modern researchers is to create a heat resistant refractory with a flexible structure, which ensures its integrity at high temperatures and mechanical loads, and which has the ability to form a protective layer.

The paper has tested the technological approach of introduction of additives containing titanium oxide (IV) and iron oxide (II) based on the  $\text{MgO} - \text{Al}_2\text{O}_3 - \text{FeO} - \text{TiO}_2$  [1] system into the raw material charge.

The main component of periclase-spinel refractories is periclase, which has a high melting point and is highly resistant to alkaline fluxes and slags. Spinel is the second component that is introduced into the composition of periclase-spinel materials, which contributes to a significant improvement in the performance characteristics of these materials. The addition of  $\text{TiO}_2$  promotes compaction of spinel and protects it from intense oxidation. The presence of  $\text{FeO}$  promotes the formation of a protective layer at the contact of the cement clinker with the refractory.

As a result of the conducted studies, it was found that the introduction of additives based on titanium oxide (IV) and iron oxide (II) into the composition of periclase-spinel materials contributes to a specific structural phase adaptation of the material and preservation of the integrity of the products of it, at the same time exposure to cyclic thermal loads, corrosion and abrasion wear in rotating furnaces.

### References:

1. Borysenko O. Subsolidus structure of the  $\text{MgO} - \text{Al}_2\text{O}_3 - \text{FeO} - \text{TiO}_2$  system / O. Borysenko, S. Logvinkov, G. Shabanova, Y. Pitak, A. Ivashura, I. Ostapenko // Chemistry & Chemical Technology. – 2022. – Vol. 16, No 3. – P. 367–376. <https://doi.org/10.23939/chcht16.03.367>.