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TO DETERMINATION OF THERMOPHYSICAL PARAMETERS FOR HALF-FINISHED PRODUCT MAGNISIA-SPINEL AND MULLITE-CORUNDUM REFRACTORIES IN THE PROCESS OF ITS BURNING

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There are presented the results of experimental research of thermophysical parameters of half-finished product of row of magnesia-spine and mullite-corundum refractories at them burning in tunnel furnaces.

Keywords: coefficients of temperature conductivity and heat-transfer capacity, heat capacity, half-finished product, magnesia-spine and mullite-corundum refractories, burning, tunnel furnace

Thermophysical parameters (heat-transfer capacity, temperature conductivity, and heat capacity) are major characteristics of refractories, which by largely determine their application domain, construction and quality of work for thermal aggregate, and also expense of fuel.

The value of thermophysical parameters of refractories during their burning especially grows from intensification of work many metallurgical and other technological processes. The wide use of computer technique for difficult thermal calculations (in particular, for the decision of nonlinear tasks) also is by cause the necessity of receipt of more exact data in relation to the above-mentioned parameters of refractories.

Many works are sacred to sufficiently research of dependence of thermophysical characteristics for different types of refractories from their physics-mineralugical composition, structure and level of temperature [1-3]. At the same time information about the thermophysical parameters of half-finished product in the process of it burning is only for the limited quantity of industrial refractories [4,5].

It is known that the thermophysical parameters of half-finished product of burned refractories depend on it aggregate state which is determined by kinetics of physical and chemical processes. In turn, such processes are carried out at times with intensity which depends on the temperature state of elementary volumes of half-finished product of refractories. The indicated intercommunication is characterized by the numeral values of complex index of thermophysical parameters of half-finished product of refractories - coefficient of temperature conductivity $à_{ef}$.

For determination of temperature conductivity coefficient $à_{ef}$ of refractories which investigated, used regularities to law of the quasistationary thermal mode. Such method is based on the decision of equation of heat-transfer capacity for a plate after linear change of temperature on it surface in the time period $\Delta\tau$, that allows to get a formula for the calculations of coefficient of temperature conductivity [6]:

$$a_{h.f} = \frac{\left(\tilde{N}_h\right) \cdot S^2 \cdot \left[1 - 2\Phi_c\left(Fo\right)\right]}{2\left[\Delta T - 2\Delta T_0 \cdot \Phi_c\left(Fo\right)\right]}\ , \qquad (1)$$

where $2S$ is a thickness of plate; ΔT_0, ΔT are accordingly drop of temperature between a surface and center of plate at the beginning and at the end of period of time $\Delta\tau$; $\Phi_{\tilde{n}}\left(Fo\right)$ is a function of Fourier criterion for the middle of plate.

The thermophysical parameters of half-finished product of magnisia-spinel (magnesite and magnesite-chromite), and also mullite-corundum refractories, investigated during burning in the high temperature tunnel furnaces of OAS «Zaporozhe heat-resistant plant».

The control samples of half-finished product set in different stakes of charge of refractories, which investigate. Located on the furnace trolleys, and burned out after the existent technological modes. During implementation of experiments there are measured the drop of temperature ΔT on a surface and axle of half-finished product with the use of tungsten-rhenium thermoelectric thermometers in corundum boots, protected by rare gas (an argon), and also controlled time of delay $\Delta\tau$ temperature on axle of half-finished product in relation to a temperature on it surface.

For simplification of calculation part during determination of values of coefficient of temperature conductivity a graph-analytic method is applied [6]. According to this method the temperature-sentinel mode of heating of half-finished product was divided into areas within the limits of which change of temperature on the surface of sample was near to linear and computed the value of coefficient of temperature conductivity for every area depending on the middle temperature of half-finished product.

The middle effective heat capacity of half-finished product during it burning was calculated by rule of additively, which takes into account both the value of this parameter for the different components of high-heat charge and presence of thermal effects which take place in the process of burning [7]:

$$\tilde{N}_{ef} = \tilde{N}_{T_b}^{T_e} \pm \frac{W}{\rho \cdot \left(T_b - T_e\right)}\ , \qquad (2)$$

where $\tilde{N}_{T_b}^{T_e}$ is a middle heat capacity of half-finished product of refractories of corresponding mineralogical composition in the interval of temperatures $T_e \ldots \grave{O}_e$; $C_{T_b}^{T_e} = \sum_{i=1}^{n}\left[\left(C_{T_b}^{T_e}\right)_i \cdot m_i\right]$, $\left(\tilde{N}_{T_b}^{T_e}\right)_i$ is a middle heat capacity of i component half-finished product of refractories which investigate in the interval of temperatures $T_e \ldots \grave{O}_e$; m_i is a concentration (after mass) of i component in an half-finished product; i = 1,2,.. is quantity of components in a half-finished product; W is specific power of sources $(+)$ taking $(-)$ of warmth exo- and endothermic reactions.

Effective values of coefficient of heat-conducting λ_{ef} for the half-finished product of types of refractories, which investigate, that it is expected with the use of equation $\lambda_{ef} = a \cdot C_{ef} \cdot \rho$, where ρ is a superficial closeness of half-finished product, kg/m^3.

The results of experiments testify to the presence enough difficult character of temperature dependence for coefficients heat-transfer capacity and temperature conductility of half-finished product of refectories which investigated.

Conclusions. The complex of experiments, devoted to the study of thermophysical parameters of half-finished product for magnisia-spinel and mullite-corundum refractories during its burning at high-temperature tunnel furnaces is carried out.

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