RATIONAL USE OF REFRACTORIES IN REGENERATOR CHECKERS

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The thermal efficiency of regenerators in glass furnaces depends on the rational choice of the checker system and the refractory materials used in their construction. At present, efficient operation of regenerators during the campaign of the furnace in Soviet glass factories is mainly limited by the resistance of the refractories.

Using various magnesia refractories in sheet glass furnaces for building the checkers in many glass factories (Misheronsk, Borsk, Panevezhe, Anzhero-Sudzhensk, etc.) permits a significant increase in their service life and a sharp reduction or complete exclusion of hot repairs when the refractories are replaced.

At the same time, in some factories, replacing aluminosilicate refractories in sheet-glass furnaces by magnesia did not markedly increase the life of the checkers. This indicates that magnesia refractories are being used without taking into account their specific properties and the working conditions of the checkers.

In tank furnaces producing alkaline and borosilicate glasses for medical purposes, the life of the checkers made from aluminosilicate refractories does not exceed 6-8 months. In this case, the residual thickness of the bricks in the upper courses of the checkers is reduced from 65 to 30-40 mm; the surface of the bricks is vitrified, and we often observe caving-in of the checkers. Experience with the use of magnesia in checkers for such furnaces is almost totally lacking.

According to literature data, the use of magnesia refractories may provide a service life for regenerator checkers without replacing the structure throughout the campaign (5-6 years) for the production of practically all industrial glasses [1-3].

In order to develop practical recommendations for the rational use of refractories in checkers for sheet glass, container, and medical-glass furnaces, the State Institute of Glass and the Institute for Medical Polymer Research carried out an all-round investigation of the resistance of aluminosilicate and magnesia refractories in laboratory conditions, modeling the actual service conditions of the material in the checkers.

We selected refractories produced by Soviet industry for the tests: magnesite ordinary MO-89, compressed magnesite MU-91, magnesite-chromite ordinary, MKhSO, periclase-spinel ordinary, PShSO, forsterite F, unfired magnesite-chromite BMKh, chamotte ShN-38, and high-alumina DV-12.

Bearing in mind the corrosive nature of the atmosphere in the various zones of the checkers, tests were done both in conditions in which the refractories were affected by volatile compounds of sodium, potassium, boron, and sulfur in the range 800-1300°C, and also with a determination of the thermal corrosion resistance of the bricks in molten sodium carbonate, sodium sulfate, potassium carbonate, and boric acid at 1000°C.

The resistance of the refractories in the corrosive conditions of volatile components was determined by a method which essentially is as follows. The specimens of T-shape in section, measuring 15 x 15 mm and height 60 mm with a head measurement of 20 x 20 x 2 mm, were established in grooves of square section in a platinum cover, tightly covering a platinum crucible of 2-liter capacity. On the bottom of the crucible was placed 240 g mixture of powdered components: sodium carbonate and sodium sulfate; sodium carbonate and potash; sodium carbonate, potash, and boric acid in various ratios. We simultaneously tested 12 specimens of refractories (three specimens of four different types).

The crucible was placed in a chamber furnace with silit heaters. Experiments were done at 800, 1000, 1200, and 1350°C with a temperature rise rate of 200 °C/h and a soaking at the...
In terms of corrosion resistance, the refractories can be arranged in the following order: MU-91, MO-89, PShSO, MKhSO, F, BMKh, DV, and ShN-38. It should be noted that all types of magnesia refractories have a high resistance, while the aluminosilicate bricks are characterized by noticeable damage with partial fusion of the surface, and the formation of reactive contact zones (Fig. 1-2).

The thermal corrosion resistance of the refractories was studied by the heat-exchange cycling method, using periodic holding of specimens in the melt, followed by sudden cooling. The mixture of starting components in the prescribed ratio was charged into the platinum crucible, heated to 1000°C, and held for 30 min. The choice of this temperature is due to the commencement of condensation at this point of the corrosive volatile compounds contained in the flue gases. Then the specimens of refractory in the form of 20 mm cubes were lowered into the melt, suspended on platinum wire. After holding for 60 min the specimens were extracted from the melt and subjected to sudden cooling in a stream of ventilation air. After 10-15 min they were again heated in the melt followed by cooling. The specimens withstood from 1 to 6 heat cycles before being completely destroyed, which depended on the type of refractory.

Thermal corrosion tests showed the significant advantages of the basic refractories of the magnesite type compared with aluminosilicate (Figs. 3 and 4). In terms of thermal-corrosion resistance the refractories were placed in the following order: PShSO, BMKh, MKhSO, F, MU-91, MO-89, DV, and ShN-38. We should stress the very low resistance of aluminosilicate brick. Thus, the specimens of chamotte refractories in molten sodium carbonate, potash, and boric acid were completely destroyed after one heat cycle.

In terms of the allround assessment of the resistance of magnesia and aluminosilicate refractories to the corrosive action of volatile components, and the thermal corrosion resistance in melts, it is considered most rational to use, for regenerator checkers when