Soviet insulating materials based on high-alumina wool have thermal characteristics that are equivalent to those of the best foreign specimens. Two types of product from the Bogdanovich Refactories Factory (kaolin wool as specified by TU 14-8-107-74, and heat-insulating tiles TU 14-8-159-75) have received the State Quality Label.

The demands by industry for new and improved heat-insulating materials become more stringent every year. The development of such materials and also special designs for heating equipment will help solve the problem of boosting the effectiveness of the furnaces.

**LITERATURE CITED**


**AIR-SETTING SOLUTION FOR FIBROUS HEAT-INSULATING MATERIALS**

M. M. Mirak'yan and A. N. Gao du

Owing to the rapid increase in the production and use of fibrous refractory heat-insulation products, it has become necessary to develop a mortar solution to cement such products together and to cement them to the refractory lining or metallic elements of furnace plants.

Alumina was used to develop the mortar solution. To prepare the solution, the powdered components of the charge were mixed in the dry condition, and water–glass was added to give a homogeneous mass.

In the cementing experiments we used slabs measuring 40 x 40 x 20 mm made of the following materials: "Kerlane" refractory roofing material (open porosity P ~ 96%), refractory felt grade 10 from the Severskii dolomite works (P = 90.7%), "Pyronap" refractory felt (P = 88.5%), lightweight VGLDS-0.5 products made from diathene–sillimanite concentrate (P = 62%), lightweight corundum products from the Semiluk refractories works (P = 62%), Dinas (P = 25%), corundum products (P = 18–20%), and compact kaolin products (P = 8–12%).

The consistency of the mortar solution was determined by the StroiTsNIL cone test; its water retention was measured by filtering the solution on a Buchner funnel. In this test we found the water loss from the solution after 30 min of vacuum filtration on a filter pump. The water retention was also estimated from the

<table>
<thead>
<tr>
<th>Slab material</th>
<th>Shear strength, kgf/cm²</th>
<th>Type of shear*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>after heat treatment</td>
<td></td>
</tr>
<tr>
<td>temperature (°C) of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>110 900 1200 1400</td>
<td></td>
</tr>
<tr>
<td>VGLDS-0.5 products</td>
<td>13.3 8.7 10.1 8.6</td>
<td>OM</td>
</tr>
<tr>
<td>Lightweight corundum products</td>
<td>21.5 15.0 20.4 18.5</td>
<td>MO</td>
</tr>
<tr>
<td>Dinas</td>
<td>42.6 37.7 23.8 22.2</td>
<td>MO</td>
</tr>
<tr>
<td>Dense kaolin products</td>
<td>72.5 19.9 50.4 56.8</td>
<td>M</td>
</tr>
</tbody>
</table>

*OM, greater in refractory than in mortar; MO, greater in mortar than refractory; M, in mortar.
duration of emission of water into a refractory or other slab from the time at which it was coated with the mortar solution.

The characteristics of the air-drying mortar solution were as follows.

Grain-size composition of dry mixture, %:

- fraction > 0.06 mm ................................... 4
- < 0.06 mm ........................................... 96

Contents of particles of various dimensions in < 0.06-mm fraction, according to Figurovskii method:

- 60-50 μm ........................................... 3.0%
- 50-40 μm ............................................. 3.0%
- 40-30 μm ........................................... 10.0%
- 30-20 μm ........................................... 16.5%
- 20-10 μm ........................................... 7.0%
- 10-5 μm ........................................... 6.5%
- 5-2 μm ............................................. 6.5%
- < 2 μm ............................................. 32.5%

Refractoriness, °C ........................................... 2050

Chemical composition of calcined substance, mass %:

- SiO₂ ............................................... 14.89
- Al₂O₃ .............................................. 76.92
- Fe₂O₃ .............................................. 0.03
- MgO .............................................. 0.53
- Na₂O .............................................. 6.88

Moisture content of solution, % ................... 32

Consistency of solution, cm .......................... 10.5

Apparent density, g/cm³ ................................. 2.02

Water retention:

- water loss during filtration, % ........... 28.1

duration of water emission from solution, min to slab of:

- Refractory felt 10 ................................ 12
- Pyronap ........................................... 28
- Kerlane ........................................... 5
- Dense kaolin brick ................................. 2.33

The binding power of the solution was assessed by the usual method [1] as the shear strength of the mortar on the refractory. The cemented slabs were dried in air, then in a drying cupboard at 110°C, and fired at 900, 1200, or 1400°C in electrical resistance furnaces. Owing to their elasticity, the slabs of fibrous materials could not be used in the usual mechanical tests, and therefore the binding properties of the solution were determined with slabs of lightweight and dense refractory materials (see Table 1).

The adhesive properties after drying and firing at the same temperatures were determined from the surface layer of mortar and the cemented joint, by means of visual observations of the presence of cracks, firecracks, the degree of welding of the mortar to the slabs, the strength of the layer of joint, etc.

In a qualitative assessment of the surface layer we found that all the specimens had good adhesion between the mortar and the slabs; the layers were relatively thin (1-1.5 mm) and strong, despite the presence of cracks in some cases. The mortar causes firecracks in the surface layers of slabs of Dinas, corundum, and kaolin refractory, and also promotes cracking in slabs of VGLDS-0.5 (in some cases cracks were also observed in Dinas slabs after firing at 1200 or 1400°C).

A study of the properties of corundum mortar solution cemented to refractories with various porosities and structures revealed that the mortar gives good joint quality, adequate strength, and low shrinkage, manifesting these properties on drying and in the temperature range under test (900-1400°C). The qualitative indices of the mortar are at the same level as those of analogous non-Soviet mortars.