DETERMINING THE OPEN POROSITY AND APPARENT DENSITY OF UNFIRED REFRACTORIES

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UDC 666.762.3.017:620.192.47

The open porosity and apparent density of unfired refractories (magnesite, magnesite—chromite, and chrome—magnesite) are currently determined in accordance with GOST 2409-67 using kerosene as the impregnation liquid. A careful check of this method on laboratory specimens and industrial products has shown that it gives large errors unless the specimens are first prepared correctly, i.e., by eliminating the binder substance.

The sulfite waste liquor used as plasticizer and binder in unfired refractories clogs their pores and prevents impregnation with the liquid in porosity determinations according to GOST 2409-67. The resulting error is the greater the more binder has been added to the mix (Table 1), e.g., an increase in the binder content by 1.67% reduces the porosity of the product by 5.7%.

Determinations of the open porosity and apparent density of specimens from an unfired nozzle of the Zaporozh'e Plant by the standard method and after the elimination of the sulfite waste liquor from the specimens gave the results shown in Table 2.

TABLE 1

Waste sulfite liquor in the specimen*, % on the dry substance	Open porosity determined according to GOST 2409-67, %	
	after drying specimen at 150°C followed by impregnation with kerosene	after baking specimen for 2 h at 900° followed by impregnation with water
0,96	18,4	24,0
1,70	15,2	24,1
2,03	14,6	23,7
2,63	12,7	23,1

*The production conditions were identical for all specimens.

The data in Tables 1 and 2 show that the current method of determining the porosity of unfired refractories gives inaccurate results so that prior to the determination of these indices the binder must be eliminated from the specimen by baking at 800-900°C.

The baked specimens are strong enough and are not significantly hydrated by the action of the water. This makes it possible to impregnate the specimens with water when determining the porosity by the method specified in GOST 2409-67 so that the process is simplified and the working conditions improved.

The error in porosity determinations resulting from the hydration of some of the free calcium oxide in the specimen is small and does not exceed 0.5% (abs).

TABLE 2

Specimen No.	Open porosity, %		Apparent density, g/cm³	
	after drying the specimen at 150°C followed by impregnation with kerosene	after baking the specimen at 700°C followed by impregnation with water	after drying the specimen at 150°C followed by impregnation with kerosene	after baking the specimen at 700°C followed by impregnation with water
1	16.2	29.0	2.58	2.48
2	15.7	28.1	2.59	2.48
3	15.6	29.0	2.59	2.47

Ukrainian Scientific-Research Institute for Refractories. K. Marx Refractories Plant, Panteleimonov.
Translated from Ogneupory, No. 12, pp. 51-52, December, 1975.

The porosity determined by the method proposed here will correspond to that of the refractory in service after the burn-out of the binder.