ALKALI RESISTANCE (AR) OF REFRACTORY LINING MATERIALS (BRICKS AND CASTABLES)

BACKGROUND

Refractory lining materials such as bricks and castables etc. are susceptible to alkali attacks. As we already know that alkalies (Na_2O and K_2O) are very damaging to refractories, and can reach them either in liquids or in gases. The resistance of Zircon and Zirconia refractories to their attack (at glass-making temperatures) comes mainly from the non-wettability quality of these compositions with respect to alkalies. We have also seen that carbon resists wetting by silicate slags, and graphite is also resistant to wetting by many liquid metals as well as by slags and fluxes. In cement or lime rotary kilns attacks from alkali vapours or alkali salts take the form of an infiltration at the surface of refractory lining, with consequential adverse impacts on the bonding (bricks, castables or mortars).

Such damage may already occur at temperatures in the range of 800 - 900°C. Refractory lining, the *alkali resistance (AR)* of which is unknown, can be tested according to the following instructions (based on DIN 51069 standards).

TEST SPECIMEN

Refractory Bricks (Lining)

Cut the sample from a standard refractory brick. The size must be half of a standard brick, i.e. approximately 114 x 114 x 65 mm, with a hole having a diameter of 35, 40, 45, or 50 mm and a depth of 40 mm. Then dry the sample at 110^OC.

Refractory Castable

Cast the test specimen (piece) on a vibrating table. The size of the test specimen must be approximately 80 mm in outside diameter, with a height of approximately 65 mm and a hole which is 35 or 40 mm in diameter and 40 mm deep. After casting, the specimen must be dried at 110^OC and burnt at 1200^OC for five hours in an electric furnace.

TESTING

Put the specified quantity of anhydrous potassium carbonate (K_2CO_3) into the hole of the test piece or specimen.

See table below -

Hole diameter (mm)	Potassium Carbonate (gm)
35	32
40	38
45	44
50	50

Make a lid of firebricks, approximately 80 x 25 mm, or approximately 114 x 114 x 25 mm. Use the lid to cover the hole in the test piece and seal with air setting refractory mortar between lid and the specimen.

Burn (fire) the specimen at a temperature of 1100^OC for 5 hours in an electric furnace. Then allow the specimen to cool off. Remove the lid and cut the specimen into two halves for visual inspection.

Assessment of Alkali Resistance

The test described will subject the specimen to an environment which is more hostile than the one normally encountered by refractory lining materials, but it provides an excellent basis for comparison.

The assessment of the alkali resistance is mainly based on the depth of penetration. If the test reveals a penetration depth of less than 3 mm, without expansion and cracks (alkali bursting), the test result is considered to be satisfactory.

Usually the specification of Alkali Resistance (AR) in connection with the material designation on refractory lining drawings if any, or specifications that are required in regard to the properties of the various refractory materials concerned to resist chemical attacks of alkali salts in the form of vapour or liquid etc. are provided by the customer to the refractory supplier (vendor). Manufacturers of refractories generally furnish conventional information on their materials (Bricks, Castables, and Mortars etc.) such as, compressive and tensile strength, modulus of rupture, chemical analysis, thermal conductivity, density, porosity, refractoriness, resistance to creep and gas permeability etc. In addition, there are some special properties, determined by certain tests that have become standardized in the refractory industry. Results obtained from these tests, while not 100% conclusive, do furnish a good indication of the properties of the refractory and its resistance to various exposures within the kiln, and are the basis for the selection of a refractory particularly suited to any given area of the kiln.

Source: http://viewforyou.blogspot.in/2010/01/alkali-resistance-ar-of-refractory.html