

Calcining zone linings in cement kilns and burning zones in lime recovery kilns can exhibit alkali attack.

Alkali Attack in High Alumina Brick

In many cement kilns and lime recovery kilns in paper mills, alkali attack on high alumina refractories can be a significant contributor to refractory wear. Cement kilns typically exhibit this wear in the calcining zone just above the burning zone. In lime recovery kilns, which often have insulated linings, this wear can occur inside the burning zone.

High alumina refractory brick can react with soda (Na_2O) and potash (K_2O) to form alkali aluminosilicates. Cement kiln high alumina linings react to form potassium aluminosilicates, like kalsilite. Lime recovery kilns, with soda carryover, form sodium aluminosilicate minerals, such as albite. Alkali reactions are detrimental because they are expansive in nature. Alkali aluminosilicates have a greater volume than the original refractory. As alkali reactions progress during the lining campaign, the brickwork exhibits spalling to relieve the stresses of the greater volume.

Basic brick (that contain MgO) are more resistant to reaction with alkali than high alumina brick. Converting a high alumina brick lining to a magnesite-spinel brick lining can be a solution.

If it's necessary to stay with high alumina brick, refractories with lower contents of alumina (50% to 60% Al_2O_3) can exhibit better resistance to alkali cracking than do brick with alumina contents greater than 70%.

Alkali resistance of refractories can be qualitatively measured in the laboratory with an alkali cup test, where a refractory cube with a 1" diameter cup is packed with an alkali carbonate mixture and heated to an elevated temperature (typically 2200°F or 1050°C). Alkali resistance is measured by evaluating the degree of cracking in the samples.

A New Alkali Resistant High Alumina Brick

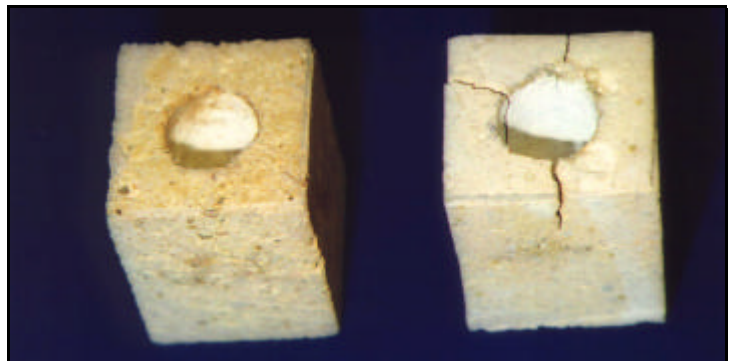
Over the past 15 years, 60% alumina brick have augmented 70% brands in the calcining zones of cement kilns and lime kiln burning zones when there is a need for increased alkali resistance.

Today Resco has developed a new 60% alumina brick for these applications. SENECA™ 60P has recently been commercialized at the East Canton, OH plant. It's advantages over traditional high fired brick are:

- Moderately better alkali resistance (see photos)
- Positive reheat expansion
- Excellent thermal spalling resistance

Improved alkali resistance can help counter expansive alkali spalling. A positive reheat expansion is often believed to help increase the tightness of the lining as it endures in service.

SENECA™ 60P can be manufactured at Resco's East Canton, OH plant in metric rotary kiln shapes from 160-mm thick to 220-mm thick, in British sized rectangular shapes (9 x 6 x 3.5 arches and wedges), as well as in cupola block sizes (9 x 6 x 4 and 9 x 9 x 4 RKB's).



SENECA™ 60P (left) exhibits less expansive alkali cracking than the current industry standard 60% alumina brick (right).

Product Data	SENECA™ 60P
Density, pcf	160
Apparent Porosity	13.8%
Modulus of Rupture, psi (ASTM C-201)	1,900
Cold Crushing Strength, psi (ASTM C-201)	8,400
Reheat Test Permanent Linear after Heating to 2912°F	+3.8%
Approximate Chemical Analysis:	
Al ₂ O ₃	61.7%
SiO ₂	30.6
Fe ₂ O ₃ + TiO ₂	4.1
CaO + MgO	0.2
P ₂ O ₅	2.6



Resco Products, Inc.
 4 Penn Center Blvd. Suite 200
 Pittsburgh, PA 15276
 Phone: 800-865-4817
 412-494-4491
 Fax: 412-494-4571
www.rescoproducts.com

What's New: Monolithics for when you can't maintain control during dry-outs.

Recently Resco introduced a new line of cement-bonded castable and gun mix products to the market, the QUICKTURN™ product family. QUICKTURN products were designed to be quickly put into service after placement and set.

Using a new and proprietary technology, QUICKTURN™ 60 PC and QUICKTURN™ 60G are designed to be placed and then heated-up to operating temperature without a 24-hour cure or a controlled dry-out. These products represent potential breakthroughs to cement plant operators.

In our laboratory, we have been unable to cause the QUICKTURN™ refractory to explode in the industry standard dry-out test.

Two installations of QUICKTURN™ 60G have already taken place in cement plants: both firing hoods. QUICKTURN™ 60 PC targets hard to dry out areas, including clinker cooler sidewalls and curbs.

Product Data	QUICKTURN™ 60 PC	QUICKTURN™ 60 G
Application	Casting	Gunning
Quantity required for placement, pcf	152	143
Density after drying (230° F), pcf	155	148
Modulus of Rupture, psi (ASTM C-201) after heating to 1500°F	2,000 - 3,000	2,000 - 3,000
Cold Crushing Strength, psi (ASTM C-201) after heating to 1500°F	9,000 - 13,000	7,500 - 12,000
Abrasion resistance, cc loss (ASTM C-704)	Typical 7 to 9	Typical 7 to 9
Approximate Chemical Analysis:		
Al ₂ O ₃	64.0%	63.4%
SiO ₂	31.9	32.9
Fe ₂ O ₃ + TiO ₂	2.7	2.6
CaO	0.9	0.9

Basic Brick Notes

■ Last month some mid-campaign measurements were taken on a RESCOMAG™ 92 lining in a 4.6-meter (15' diameter) preheater rotary cement kiln. Installed between 30' and 40' from the discharge, the RESCOMAG™ 92 maintained 86% of the original thickness (220-mm) after 4 months service. The wear rate was 0.26 mm/day in this high wear zone. RESCOMAG™ 92 is a magnesite-spinel brick designed primarily for the lower transition zone of cement kilns.

■ Multiple chamber parallel flow regenerative shaft kilns utilize 96% MgO brick for the burning zone linings of the upper chambers. In North America, the brick of choice was Oxibak H®.¹ Resco now manufactures this product at the Marelán, Quebec plant under the brand name OXILINE® H.

¹Oxibak H® is a registered trademark of Harbison-Walker Refractories Co.

Editor's Corner



I'm looking at the big 5 - 0 later this year. As I m become more jaded every day, I hold two principles dear: it's crucial to add meaningful information to the body of knowledge of the industries we serve, and sometimes it's absolutely necessary to approach a problem from a different angle.

Having worked with them for 28 years, I care about the technology that is at the core of the rotary kiln. I am concerned with the ability of our industry to recruit new engineers and managers. It's difficult to compete with the pristine surroundings of a computer terminal when you operate a 2800°F vessel that roasts thousands of tons of earth. Like it or not, the world still needs cement, lime and paper - all processes that depend on the rotary kiln.

On the way back from Vancouver a few weeks ago, I had good feelings about the conference I attended. One of the most significant activities I participated in was an eight hour-long tutorial on kiln maintenance. Never been to a tutorial before, I was impressed with the knowledge and expertise of the instructor I watched. More impressive was the caliber of the people in the room learning from the instructor-lots of plant, maintenance and production managers. That also would have been an excellent learning experience for new recruits.

* * * * *

I hate to waste things. Time especially. I hate having to do things over because the first time was not right. Unfortunately you do not always have options.

Our engineers looked at dry-outs of castable and gun mix materials from a little different angle. We don't know what the limits of our new QUICKTURN™ products are, but what we know is that we have not been able to cause an explosive failure in the lab in the dry-out test. Our field installations, to date, are consistent with the lab work. This technology may bring a solution to the lurking problem of a refractory dry-out that cannot be controlled.

* * * * *

One thing final, we just gave our website a new look. Visit www.rescoproducts.com today. Soon I promise to bring a feature to it that will help add to the body of knowledge in our industry.

Chris Macey

(christopher.macey@rescoproducts.com)