



RESCO Expands Magnesite-Spinel Product Line

Recently our Marelán, Quebec plant commercialized a new basic brick brand, RESCOMAG™ 92 FMS. Considered an upgrade to our RESCOMAG™ 92, this product targets troublesome **lower transition zone areas** in rotary cement kilns. The primary features of RESCOMAG™ 92 FMS include highly corrosion resistant raw materials in a crystalline spinel-bonded matrix.



RESCOMAG™ 92 FMS contains slag resistant raw materials to better resist attack from a liquid phase.

RESCOMAG™ 92 FMS contains special liquid phase resisting magnesia (MgO) grains and spinel (MgO-Al₂O₃) components to help counter the tendency to sinter into larger grains in the presence of a fluid liquid phase. This may help preserve resistance to thermo-chemical spalling.

Attack from chlorine and sulfur can weaken the groundmass (bond phase) of magnesite-spinel brick. Sulfur and chlorine can combine with the magnesia in the bond phase to form magnesium sulfates and chlorides, weakening the refractory. Since spinel (MgO-Al₂O₃) is less reactive to chlorine and sulfur, the crystalline spinel present in the matrix of RESCOMAG™ 92 FMS helps fortify the brick structure against attack from chloride and sulfate.

Product Data	RESCOMAG™ 92 FMS
Density, pcf	182
Apparent Porosity	18.4%
Modulus of Rupture, psi (ASTM C-201)	970
Cold Crushing Strength, psi (ASTM C-201)	4,810
Approximate Chemical Analysis:	
MgO	91.9%
Al ₂ O ₃	6.1
Fe ₂ O ₃ +TiO ₂	0.5
CaO	1.1
SiO ₂	0.4

Lower Transition Zone Wear

In many cement kilns, lower transition zone life is a limiting factor in the refractory lining campaign. Studies of wear mechanisms for the basic brick linings in this area of the cement kiln define several types of wear:

- Infiltration of alkali sulfates and chlorides
- Penetration by the clinker liquid phase
- Physical stresses.

Penetration by the clinker liquid phase, however, is the most severe wear mechanism. Refractory undergoing alteration from the clinker liquid phase exhibits enrichment of lime and silica to a depth of one to two inches from the hot face.

The changes visible under a microscope for the altered refractory show partial solution by the molten lime-rich silicate phases. The finer magnesite (MgO) particles sinter together into larger grains. At operating temperatures, these molten phases allow the refractory to be eroded away. When the kiln temperature is cooled during an operational cycle, the penetrated portion of the refractory becomes densified and the altered portions of the brick peel off (thermo-chemical spalling).

Burner positions and settings that produce localized overheating can contribute to this type of attack. Other causes of this type of attack include overheating, inconsistency in the clinker chemistry and/or process upsets.

Experience is showing that magnesia-spinel brick with magnesia contents above 90% (and lower contents of magnesia-alumina spinel) tend to resist this type of attack better than lower magnesia content brick.



Liquid phase attack at the hot face of a conventional magnesite-spinel brick changes the refractory structure and leads to erosion, cracking and spalling.



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Monolithic Refractories for Cement Kiln Cooler and Preheater Maintenance

Resco has maintained a reputation for cutting edge monolithic refractories, especially to the petroleum refining industry. Recently Resco has expanded its product development into applications for other industries.

RESCORAM™ and VIBROCAST™ are two families of monolithic refractories manufactured by Resco Products, Inc. RESCORAM™ is the brand name for Resco's refractory plastic product line. VIBROCAST™ refers to our low cement- technology castable and gun mix line.

RESCORAM™ 70 BLUE is a 70% Al₂O₃ phosphate-bonded plastic that features high green strength and excellent workability. RESCORAM™ 70 BLUE is useful for nose ring and firing hood construction, as well as general patching in the preheater.

VIBROCAST™ products are extensive in composition and feature several consistencies for ease of placement.

■ VIBROCAST™ 60 is a general duty casting low cement castable of 60% alumina content. It should be conventionally cast using immersion vibrators. VIBROCAST™ 60G is the pneumatic gunning version. For pump casting and wet shotcrete applications, VIBROCAST™ 60PC should be used.

■ VIBROCAST™ 50 and VIBROCAST™ 70 are also available for lower or higher alumina contents, and in the same application consistencies.

■ Silicon carbide containing concretes have been recognized as helping operators manage build-ups. VIBROCAST™ 56SC contains a high content of silicon carbide for this use. For best results, VIBROCAST™ 56SC should be vibration cast creating a smooth, dense surface. (Smooth surfaces reduce the tendency for build-ups to attach and make removal of the buildups easier.) Where a cast construction is not feasible, VIBROCAST™ 56SCG can be pneumatically gunned.

SUREFLOW™ is Resco's trademark for self-leveling castables. SUREFLOW™ brands come in a variety of alumina contents and compositions.

RESCOBOND™ 3000 is a monolithic product with some unique features. RESCOBOND™ 3000 is an air-setting casting mix that develops high strength and requires a minimal dry-out schedule. This product is useful where a dry-out cannot be controlled and cement-bonded concretes are prone to steam spalling. Cooler linings are good examples.

Monolithic Refractories cont.

RESCOBOND™ 3000 can also adhere to existing refractory when the old refractory surface is properly cleaned and prepared. Best properties result from conventional vibration casting. Where gunning is preferred, RESCOBOND™ 3000G should be used.

Editor's Corner

At home, my gas bill has gone through the roof. (You ought to see a refractory company's gas bill!) I expect that many of our customers will begin emphasizing energy conservation.



For many rotary kiln operators, especially in lime plants and paper mills where the kilns are fired with gas or fuel oil, shell temperatures will become a major concern. Further, protective coatings often do not form in the burning zones of many lime kilns.

Magnesite-spinel brick in lime kiln burning zones are very compatible with the process, but shell temperatures are often disappointing. Here are some suggestions.

Perhaps the most painless way to reduce shell temperature is simply to use thicker brick. Operators have 6" (150-mm), 180-mm (7.1"), 200-mm (7.9"), 220-mm (8.7") and 9" (230-mm) thickness to select from. For a larger diameter kiln, an operator can consider 250-mm (9.8"). A 250-mm lining can reduce shell temperatures by approximately 34°F (19°C) at operating temperatures (2450°F) over a 220-mm thick lining. Some lime kilns even operate with 12" thick burning zone linings.

Two-layer linings have been used in lime kiln burning zones as long as I can remember. The most successful two-layer linings use a normal density high alumina or fireclay brick against the shell. The drawback of this construction is the potential for instability during outages. Magnesite-spinel brick have much higher rates of thermal expansion in comparison to alumina refractories that can cause instability during cooling. If your kiln has frequent shutdowns, two-layer linings may not be a good option.

Insulating Kiln Liner shapes (IKL) with cold face recesses and insulation pads are being evaluated as compromises between one-layer and two-layer constructions.

Construction, weight, thermal conductivity, thickness of the refractory along with the plant's operating procedures must all be carefully evaluated in order to improve the shell temperature condition.

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