Michael Greenman

New Refractory Offers Economy, Endurance

Refractories used in oxy-fuel furnace crowns deal with conditions that pose challenges to long life: higher temperatures and an atmosphere with higher alkalinity than the typical air-fuel environment.

Utah Refractories is announcing a new silica brick available for testing that is expected to provide longer life than traditional silica brick. The brick are called "Gen-Sil LCI" (for low calcium and iron) and are the end product of research by John Brown (now retired from Corning and GMIC technical director) and the late John Wosinski (Corning refractory specialist) conducted in the late 1990s. The intended use of the brick is in high-attack areas of silica crowns, particularly in oxy-fuel furnaces with high alkali concentrations.

The Orton Ceramic Foundation tested the brick. The results showed good strength, very low residual quartz crystal and physical characteristics that match the current Gen-Sil product line.

Early laboratory results are supported by the performance of this material in a Pavisa (Mexico City) oxy-fuel furnace, where they have been in continuous use since January 2000. Pavisa Vice President Alonso Gonzalez Rodriguez (2004 winner of the prestigious Phoenix Award) confirms that the crown looks good. This is the only furnace using the brick at this point. The company manufacturing the brick closed shortly after this first installation.

GMIC organized several visits by glass and refractory company representatives to view the operational condition of the brick in the Pavisa furnace in 2004. Visitors were all impressed with the crown's state and the absence of visible degradation.

The single furnace confirms the laboratory results that demonstrated that alkali cannot penetrate the surface of the brick as it does in normal silica by traveling through the continuous paths created by "pseudowollastonite". In the Gen-Sil LCI brick the low calcium levels result in disconnected islands of this material, eliminating the travel of alkali agents beyond the hot face, thus substantially slowing the brick's erosion.

In 2001, Corning was issued U.S. Patent No. 6,313,057 relating to the research of Brown and Wosinski. After several years Corning determined that the glass industry as a whole would benefit from this technology but it was not being adopted, and so Corning assigned its rights to the patent to GMIC. GMIC then asked its member, Utah Refractories, to continue the product's development. Two years of testing and trials have resulted in a level of performance that brings the material to the point of readiness for in-furnace trials.

So, prior to general announcement of the product's availability, Utah Refractories is prepared to provide test samples to permit the glass industry to conduct trials in real-life furnace environments. Interested companies should contact Tom Mulholland at: 412-851-2430 or tlmpgh@aol.com. Individuals interested in visiting Pavisa to observe the current state of the furnace after seven-plus years of operation can call GMIC to discuss arrangements. Following a period of in-plant testing, Utah Refractories will announce the product's availability for larger scale purchase.

We will keep you informed of developments, and encourage inquiries to Utah Refractories or GMIC.

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Conventional silica
Erosion depth: 6.5–7 mm
Penetration depth: 3–5 mm

Low-lime silica
Erosion depth:1.5–2 mm
Penetration depth: 1.5–2 mm

The ASTM alkali vapor test, C-987, was used to compare silica compositions. The amount of erosion by the alkali vapor was considerably less for the low-lime silica refractory compared with the conventional silica product. Afterward, SEM was used to determine the degree of penetration of the samples by sodium. The vitreous silica product showed little penetration, primarily limited to the surface of the sample exposed to alkali. The degree of alkali penetration of the two crystalline silica samples was essentially in proportion to the CaO in the matrix.