

# KILN SUPPORT BEAMS INCREASE CAPACITY

A leading manufacturer of high alumina tile uses a tunnel kiln to fire its product at 1520°C to 1540°C. Its alumina tile line has experienced consistent growth in market demand over the last several years, and the company recently began looking for ways to increase the kiln's capacity to support the product's firing needs.

The manufacturer began experimenting with the use of a new silicon carbide (SiC) kiln support beam as part of redesign efforts to cost-effectively increase kiln capacity. The new beams not only helped increase capacity by 20%, they also extended the expected life to two times that of the SiC beams used previously.

The beams are manufactured with a material\* that is made by pressureless sintering of submicron silicon carbide powder. This results in a self-bonded, single phase, fine grained (less than 10 µm) SiC product that is 98% dense. The material reportedly has outstanding high temperature properties, including strength, oxidation resistance and low creep. It performs at temperatures other materials cannot, retaining its strength to 1650°C in oxidizing conditions and up to 1900°C in inert atmospheres (nitrogen and argon).

## Increasing Capacity

Experiments have shown that the new material exhibits high temperature

strength two to three times that of nitride bonded and recrystallized SiC refractory materials. Its strength is nearly twice that of siliconized SiC materials. As a result, the higher strength of the new beams allowed for the redesign of the kiln cars using thinner beam cross sections of 1/2 in. to replace the existing 1 1/2 in. beams.

This allowed for the addition of a fifth deck to a typical four-deck arrangement within the same kiln height and width cross section. Only the configurations of the car decks were changed. The beams themselves measure 1/2 x 1/2 x 30 in. each, spanning 24 in. with a maximum load capacity of 500 pounds per deck.

The alumina manufacturer's 20% increase in kiln capacity resulted from the increase in usable setting volume, allowing the live load to increase proportionately. According to the alumina tile manufacturer, the annual savings more than justify the investment by allowing it to avoid more costly capacity expansion alternatives, such as using periodic kilns to meet peak capacity requirements (i.e., increased fuel and labor costs).

The car conversion investment yielded a solid two-year payback, and there is no interruption of daily kiln operation since each car is rebuilt off line, just as they are periodically pulled aside for routine maintenance.

## Longer Life

In addition to capacity benefits, the higher density and closed porosity of the new material result in high resistance to oxidation, which is often the cause of failure and



**Figure 1.** The higher strength of the new beams allowed for the redesign of the kiln cars using thinner beam cross sections of 1/2 in. (right) to replace the existing 1 1/2 in. beams (left).

\*Hexoloy® SA, manufactured by Carborundum Corp.



**Figure 2.** The new beams not only helped increase capacity by 20%, they also extended the expected life to two times that of the SiC beams used previously.

short life for SiC kiln furniture. During extended testing in steam (1100°C), the material exhibited outstanding oxidation resistance as evidenced by extremely low weight gain compared to traditional SiC refractory materials. The improved oxidation resistance extends expected life to two times that of the conventional SiC beams previously used.

The material's creep resistance at high temperatures minimizes beam warpage. In tests performed at 1600°C, it showed improvement in creep resistance of greater than 400% compared to recrystallized and nitride bonded SiC.

### Conclusions

The new SiC beams offer true low mass kiln car design potential and excellent high temperature strength, allowing for a reduction of beam cross sections by some 50% and a 40% reduction in mass (weight) versus traditional refractory SiC materials—without compromising load carrying capacity.

For the alumina manufacturer, this reduced beam volume and weight has resulted in more fired product per kiln car run, maximizing furnace productivity and reducing total firing costs with no increase in cycle time. ☺

## Gain the advantages of Hexoloy<sup>®</sup> Silicon Carbide Components for your high temperature furnace applications

### Hexoloy<sup>®</sup> SA SiC Kiln Support Beams

- Reduced beam volume and weight for more product per kiln run
- Performs at temperatures other materials cannot (>1750°C)
- Excellent oxidation resistance for long beam life
- Excellent creep resistance minimizes beam warp
- Excellent thermal shock resistance, allows faster cycles - heat up and cool down
- Overall lower operating costs

### Hexoloy<sup>®</sup> SA SiC Kiln Tiles

- Ultra-thin, strong, lightweight tiles
- Thinner tiles/batts allow more useable kiln space
- As thin as 2 mm, with overall size dependent on tile thickness
- Less non-product to heat

### Other Hexoloy<sup>®</sup> SA SiC Components

- Thermocouple protection tubes
- Nozzles
- Wear Tile/Liners
- Heat Exchanger Tubing
- Custom Components
- Rollers (for roller hearth furnaces)
- Special Shapes

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