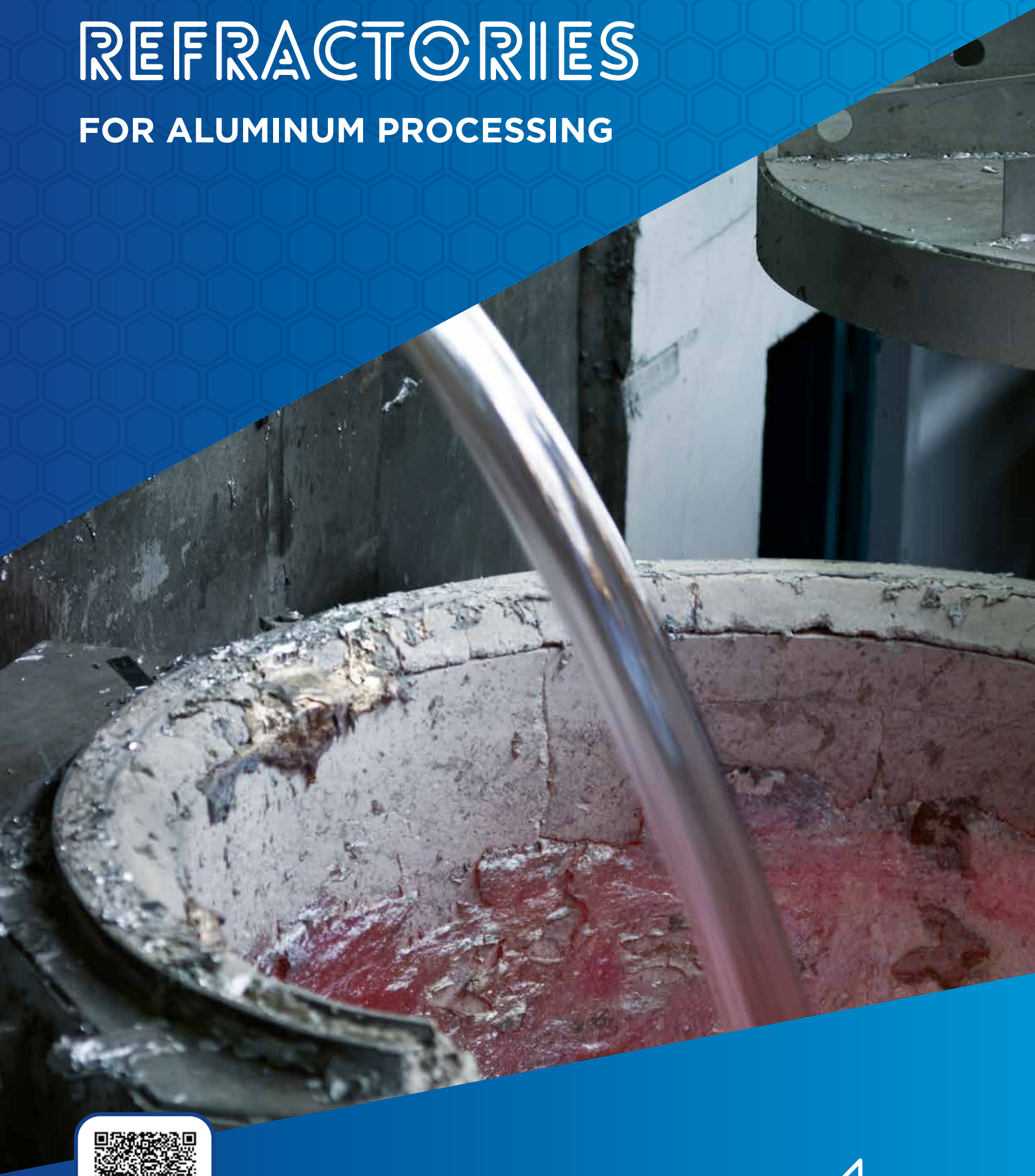
SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

REFRACTORIES

FOR ALUMINUM PROCESSING



SAINT-GOBAIN

SAINT-GOBAIN 2023

Derwent Top 100 Global Innovator 2023
Clarivate Analytics

top EMPLOYER GLOBAL 2024

1 IN 4
PRODUCTS
did not exist 5 years ago

160,000
EMPLOYEES

47.9 BILLION
SALES IN 2023

REPRESENTED IN 76
COUNTRIES

CO_2 -34 %
CARBON EMISSIONS REDUCTION
(vs. 2017 on scope 1+2)

8
MAIN R&D CENTRES

OUR PURPOSE

MAKING THE WORLD A BETTER HOME.

OUR MISSION

Saint-Gobain designs, manufactures and distributes materials and solutions which are key ingredients in the well-being of each of us and the future of all.

WE ARE COMMITTED TO ACHIEVING NET ZERO CARBON EMISSIONS BY 2050

SAINT-GOBAIN

PERFORMANCE CERAMICS & REFRACTORIES

OUR MISSION

To design, develop and **supply solutions** and **services** for **extreme operating industrial conditions.** Our **engineered ceramics** and **refractory** products are manufactured to the **highest industrial standards** and deliver **enhanced performance** while **minimizing environmental impact.**

PIONEERING CERAMIC SOLUTIONS FOR EXTREME INDUSTRIAL APPLICATIONS AND A GREENER WORLD.

EFFICIENT RESULTS

MAXIMIZE EQUIPMENT INVESTMENT AND SERVICE LIFE WITH NON-FERROUS REFRACTORY DESIGNS FROM SAINT-GOBAIN

Saint-Gobain non-ferrous metallurgy solutions deliver unparalleled corrosion, oxidation and chemical resistance to improve service life and performance under the harshest operating conditions.

Primary and secondary non-ferrous metallurgy processes require engineered refractory solutions to deliver the cleanest metal while achieving an extended and consistent service life. With years of experience, as well as a strong dedication to R&D to innovate new materials, Saint-Gobain will deliver completely customized solutions for any challenge.

BENEFITS

- Energy efficiency
- Longer service lifetime
- Minimized shutdown

OUR MATERIALS

FOR PRIMARY & SECONDARY APPLICATIONS

Reduce oxide impurities and corrosion while achieving maximum furnace longevity with high-quality oxy-nitride and nitride bonded SiC from Saint-Gobain. Nitride bonded SiC refractories, Advancal® and Refrax® ARC, have become the reference material for the sidewall lining of modern aluminum reduction cells.

Our Advancal® aluminium reduction cell material offers extended service life through improved oxidation and corrosion resistance. All our products and solutions can be manufactured with the material that meets your need to the best.

Product name	Components
Refrax® ARC	Silicon nitride bonded silicon carbide
Advancal®	High oxidation resistant silicon nitride bonded silicon carbide
Cast Refrax®	Silicon nitride bonded silicon carbide with complex shape capability
Carbofrax ® 8S	High thermal conductivity silicon carbide mortar
Jargal® M	Fused cast alumina for high purity metal
Cryston® Max	Ultra high oxidation silicon oxynitride silicon carbide
SpyroCor®	Ceramic radiant tube inserts to maximize heat release and reduce the gas cosumption
Silit® SKD	Silicon infiltrated Silicon Carbide material
Carbofrax® CC1140	High thermal conductivity silicon carbide castable

PRIMARY PROCESSING

FEATURES & BENEFITS

- Larger bath volume
- Increased power
- Lower thermal conductivity
- Lower electrical conductivity
- Superior oxidation resistance
- Excellent erosion & corrosion resistance

SIC CASTABLES

CARBOFRAX® • ANNAPLAST®

Our castable protect the top of the sidewall block against oxidation and premature failure.

JARGAL® M
Fused cast refractories for Aluminum Linings
The good capability of this material allows for the manufacture of many products and many complex-shaped pieces.

SIDEWALL BLOCKS

ADVANCAL® • REFRAX®

Our castable protect the top of the sidewall block against oxidation and premature failure.

SIC MORTARS

CARBOFRAX® • ANNAPLAST®

Carbofrax® 8S and Annaplast® APL 76 are formulated for our very well-known SiC mortars CBX 8S & APL 76 for cementing SiC sidewall blocks.

LAUNDER SYSTEM

REFRAX® • CARBOFRAX® • CRYSTON® MAX

Launder systems for aluminium transfer and casting.

Saint-Gobain also provides pouring spouts and baffle plates.

DEGASSING ROTARS

CAST REFRAX®

Refrax® rotors provide sustainable, chemical resistance for degassing unit components. High toughness and chemical inertness of our materials enhance your performance.

IMMERSION HEATER TUBES

CRYSTON® MAX • CRYSTON® NICARB • CRYSTON® CERTS • N-DURANCE®

High density oxy-nitride silicon carbide tubes and flame diffusers offer superior cost-benefit. Cryston® Max materials offer the optimal thermal conductivity and chemical resistance to keep metal molten in aluminum degassing and holding units.

RADIANT HEATER TUBES

CRYSTON® NICARB

Our range of heater protection tubes have high mechanical integrity and homogeneity, together with high emissivity and thermal conductivity at elevated operating temperatures. NICARB material remains unchallenged on performance and value for arduous applications.

Our tubes provide an efficient way to electrically heat aluminium holding furnaces without risk of premature element failure due to aluminium splash and corundum growth, or heating by recuperative gas fired systems.

THERMOCOUPLE TUBES / SHEATHS

CRYSTON® CERTS • REFRAX® 20E
CRYSTON® NICARB

Refrax® and Cryston® properties of excellent thermal shock, high thermal conductivity, chemical inertness and hot strength make it the ideal choice of material.

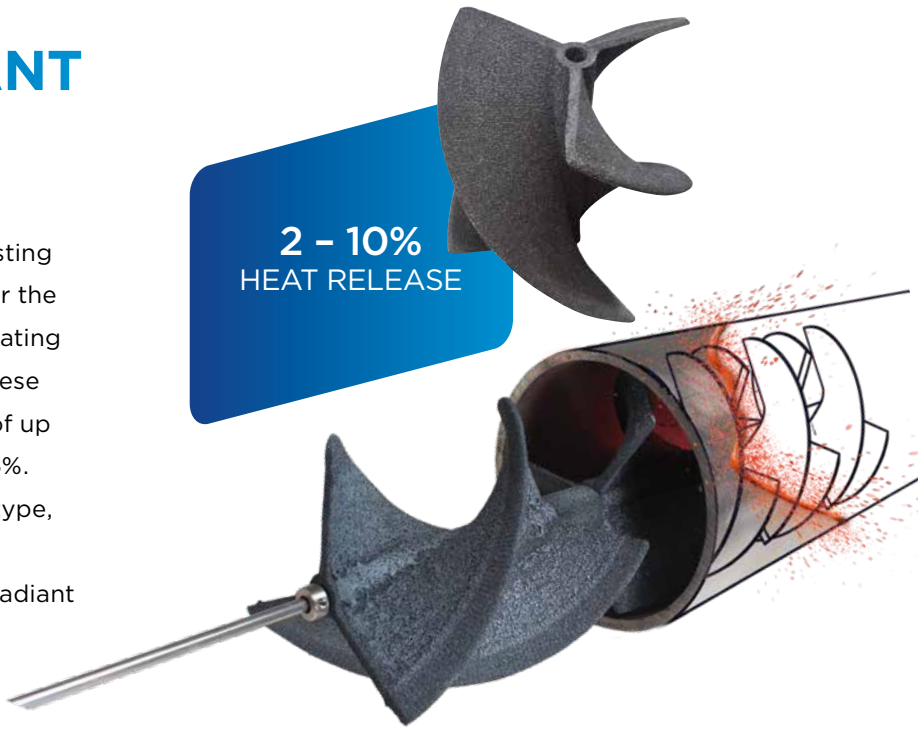
HEARTH BRICKS

CRYSTON® MAX

Cryston® Max hearth bricks provide excellent resistance to mechanical shock in loading areas of the furnace. Extend the time between furnace re-lines with our proven material.

SPYROCOR® RADIANT TUBE INSERTS

These inserts can be easily retrofitted into existing radiant tubes to improve efficiency and bolster the amount of heat that the radiant tube is re-radiating into the furnace chamber. By implementing these inserts, users can experience energy savings of up to 15% or throughput improvements of up to 5%. Available for simple installation in straight, U-type, W-type, and tri-type radiant tubes.
Also applicable in P-type and double-P-type radiant tubes.

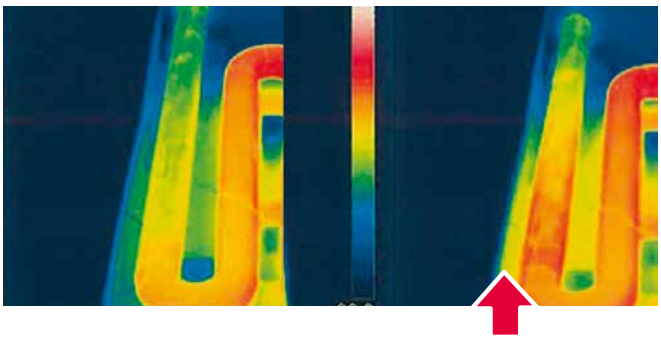


FEATURES

- Patented twist fin design
- Absorbs heat energy
- Re-radiates heat back into the furnace
- 2 - 6 % throughput improvements

BENEFITS

- **Reduction of exhaust temperature**
- **Improved energy efficiency**
- **Reduction of polluting emissions**



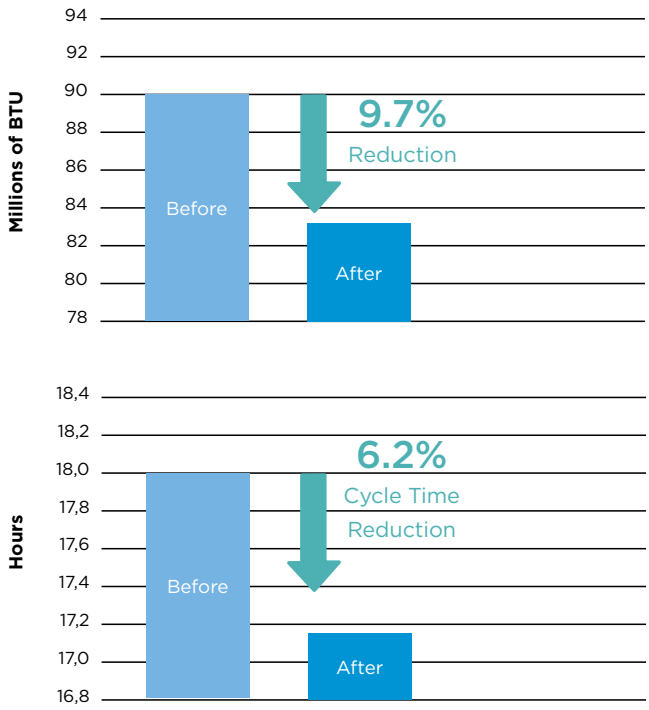
More heat into the furnace allows operators to reach YOUR desired temperature faster and boost throughput.

CASE STUDY

Aluminum slab reheating furnace with W-type Radiant Tube & 567,000BTU/Hr burner

Energy saving: 9.7%
Additional capacity: +28 cycles / year
ROI*: 4 months

Natural gas consumed per furnace cycle



*Energy savings represents an average at gas cost of $4.00/MMBZU.

HEATCOR™ RECUPERATOR

ACHIEVE **80%+** COMBUSTION EFFICIENCY

A 3D-printed ceramic recuperator that pre-heats combustion air for high efficiency burner performance.

HEATCOR™

- Thin-wall silicon carbide offers the highest rates of heat transfer and thermal performance
- Variable twist and channel cross-section provides optimized efficiency with controlled pressure drop
- Working temperature up to 1,350°C

BENEFITS

- **Excellent thermal conductivity**
- **3x higher rates of heat transfer**
- **Custom designs for optimizing application variability**

NOXBUSTER®
RADIANT TUBE INSERT

UP TO **50%+**
REDUCTION
OF NOx EMISSIONS

NOxBuster® patented design permits the recirculation of flue gasses within the radiant tube.

NOXBUSTER®

- Novel technology eliminates NOx at the source
- Safer and less costly than competing downstream solutions
- Low maintenance

BENEFITS

Significant energy and maintenance savings via hot-spot elimination

Combined with SpyroCor®, achieve temperature uniformity up to 83°C / 150°F

DISCOVER OUR ENTIRE PRODUCT RANGE

Saint-Gobain Performance Ceramics & Refractories' extensive portfolio of ceramic materials is available in many shapes and sizes.

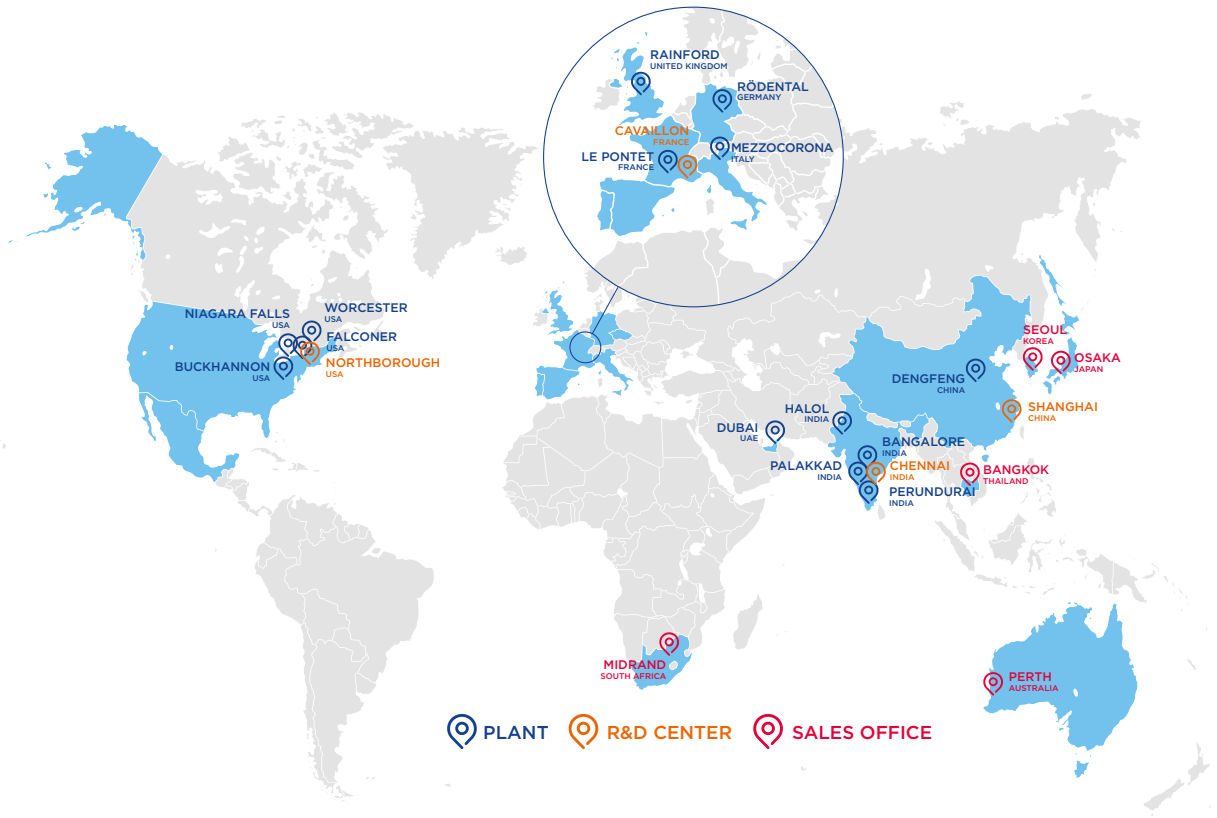
	SILICON CARBIDE (SIC)			
PRODUCT TYPE	SILICON NITRIDE BONDED SIC			OXI-NITRIDE BONDED SIC (patented mixture)
BRAND	REFRAX® ARC	ADVANCAL®	CAST REFRAX®	CRYSTON® MAX
Bulk Density (g/cm³)	> 2.58	> 2.6	2.6	2.62
Apparent Porosity (%)	17	< 19	15	16
Max. Service Temperature (°C)	1550	1550	1450	1590
Modulus of rupture at 20°C (MPa)	30	> 30	60	35
Modulus of rupture at 1350°C (MPa)	50	-	50	51 (1250°C) 41 (1450°C)
Thermal conductivity at 1000°C (W/mK)	18.5	-	13.8	-
Thermal expansion 20-1000°C, 10-6/K	0.4	4.9	0.4	5 (up to 1500°C)
Cold crushing strength (MPa)	165	165	-	-
Thermal shock resistance	> 30 cycles	-	-	-
Features & Benefits	▪ high strength ▪ greater resistance to thermal shock ▪ exceptional resistance to abrasion and chemical attack ▪ unprecedented dimensional stability	▪ commonly used for sidewall linings of Aluminium Reduction Cells ▪ exhibits high strength ▪ offers outstanding corrosion, chemical and oxidation resistance	▪ chemically inert to most materials ▪ extreme hardness provides outstanding erosion resistance ▪ complex geometrical shapes	▪ exceptional resistance to oxidation and chemical attack ▪ high strength and exceptional abrasion resistance ▪ deal for use in copper shaft and holding furnaces

TYPICAL VALUES

			FUSED CAST MATERIAL
REACTION BONDED SILICON INFILTRATED SIC	MONOLITHIC CASTABLES		ELECTROFUSED ALUMINA
SILIT® SKD	CARBOFRAX® 8S	CARBOFRAX® CC1140	JARGAL® M
3.0	1900	2600	3.17
0	-	-	-
1380	1400	1450	> 1750
260	-	-	-
260 (1200°C)	18 (1400°C)	-	-
35	> 5 (800°C)	7	-
4.5	-	-	-
-	-	30 (110°C) 25 (3 hrs MST)	> 200
-	-	-	-
▪ high thermal conductivity, little to no apparent porosity, high mechanical strength, oxidation resistance ▪ products can be made in large sizes and complex shapes ▪ excellent as-fired dimensional accuracy	▪ high purity, air setting monolithic bedding mortar ▪ used for the jointing of silicon carbide ▪ excellent strength and has the ability to operate over a range of temperatures	▪ high purity silicon carbide based mortar ▪ excellent strength with increased temperature ▪ excellent choice as a general purpose castable where heat dissipation is required ▪ initially developed for non-ferrous applications	▪ regular cast, electrofused 95% Al_2O_3 (alpha-beta alumina) ▪ extremely low defect potential ▪ High resistant to alkali vapor and creep for superstructure application ▪ available in various shape and size

SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

OUR GLOBAL PRESENCE



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