SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

# WEAR RESISTANT TECHNOLOGIES

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SAINT-GOBAIN

Derwent Top 100 Global Innovator 2023

Clarivate Analytics

# SAINT-GOBAIN

top EMPLOYER GLOBAL 2023

**1 in 4** products did not exist 5 years ago

**170.000+** employees

2022 sales of **€ 51.2** billion

represented in **76** countries

**-27%** carbon emissions reduction (vs. 2017 on scope 1+2)

**8** main R&D centres

## 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.

## OUR PURPOSE

**MAKING THE WORLD A BETTER HOME.**

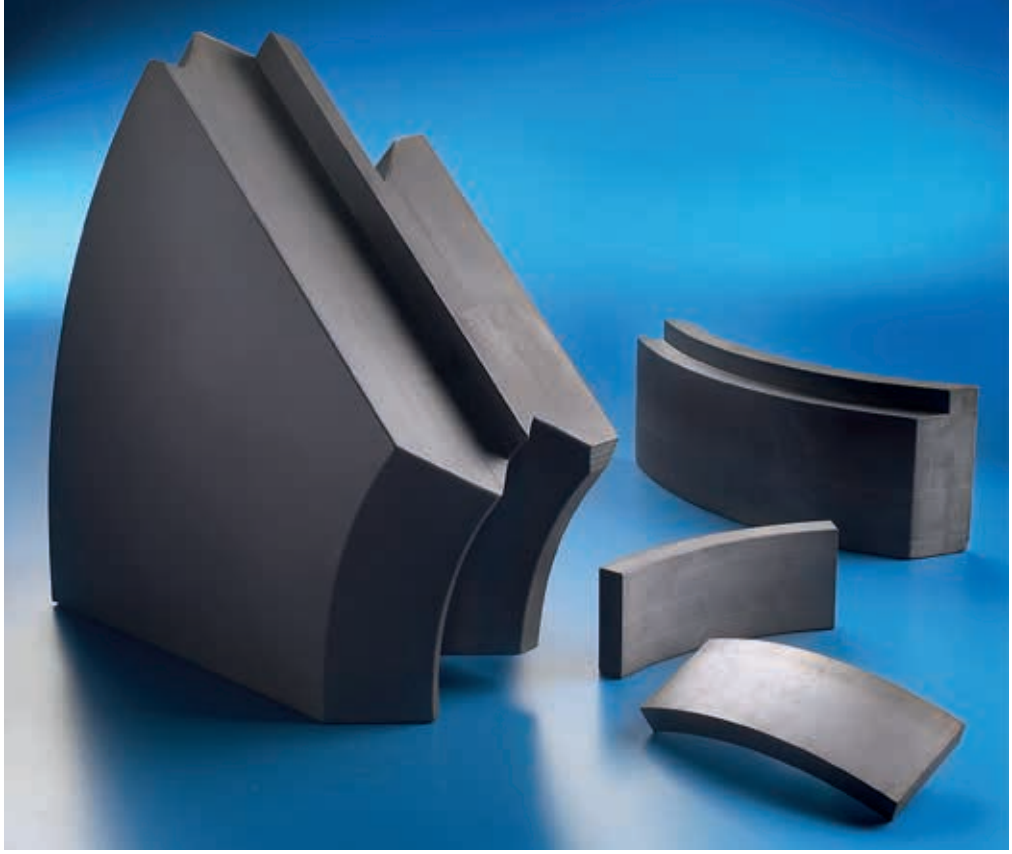

# SAINT-GOBAIN

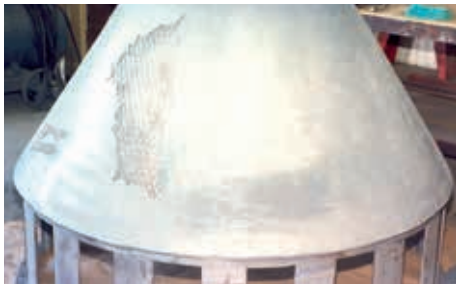
## PERFORMANCE CERAMICS & REFRACTORIES

## 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.





# WEAR RESISTANT TECHNOLOGIES

Saint-Gobain's Wear Resistant products and solutions are developed with a focus to serve applications across various markets that need resistance to numerous types of wear.

Our expertise in material science combined with in-depth knowledge of application, design, manufacturing engineering and installation expertise enables us to offer customized ceramic material solutions for various applications across a multitude of industries.

The applications we support are relevant across a wide range of industries. A few of them are listed below.

## KEY MARKETS

- MINING & MINERAL PROCESSING
- IRON MAKING
- CHEMICAL PROCESSING
- COAL FIRED POWER
- POWDER & BULK SOLIDS
- GRAIN HANDLING
- CEMENT
- RECYCLING
- AGGREGATES
- ASPHALT
- PULP & PAPER
- ENVIRONMENT

## ULTRA FINE SINTERED ALPHA-ALUMINA OXIDE ($Al_2O_3$)

Ultra fine-grain, sintered high grade pressed alumina for various types of abrasion.

### DURAFRAX®

- versatile material suitable for a range of applications
- most cost effective wear resistant material
- FDA approved for grain & food processing

## NITRIDE BONDED SILICON CARBIDE (NBSiC)

High performance dense NBSiC ceramic refractory with complex shapes‘ capabilities.

### CRYSTON® (MAX. 1590°C) & CAST REFRAX® (MAX. 1450°C) - CAST

- good wear-resistant cast material
- large and complex shape capabilities
- good thermal shock resistance

### CRYSTON® TW - CAST

- improved wear and thermal shock resistance over a standard NBSiC
- thin wall components

### REFRAX® 20 - PRESSED

- good wear-resistant pressed material
- improved oxidation and thermal shock resistance due to higher porosity
- capable of tighter tolerances due to pressed forms
- lower price than Cast SiCs

# REACTION BONDED SILICON CARBIDE (RBSiC / SiSiC)

Premium cast silicon carbide material provides excellent wear resistance and is engineered to resist oxidation and thermal shock.

### NORFRAX® RB (MAX. 1350°C) & SILIT® SKD (MAX. 1380°C)

- better wear resistant cast material
- good chemical resistance to molton salts (Na+), Chlorine, Sulphur and Nitrogen Oxides
- large and complex shape capabilities

### HAMMERFRAX®

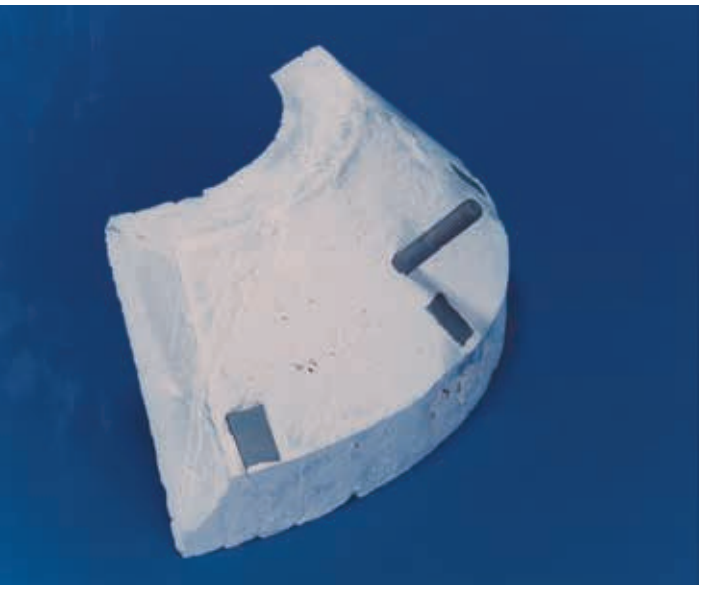
A patented product, it is an ultra-premium silicon carbide material engineered to resist abrasion and mechanical shock.

- best wear resistance over other standard SiSiCs
- large and complex shapes with exceptional dimensional accuracy

# HEXOLOY®

Premium sintered alpha silicon carbide pressed or extruded to customizable complex shapes providing maximum performance.

- superior resistance to wear, corrosion and oxidation
- extreme hardness and mechanical resistance
- excellent resistance to thermal shock
- customized complex and intricate shapes
- maximum use temperature 1900°C



## ALUMINA ZIRCONIA SILICA (AZS)

Fused cast product with its interlocking crystalline structure, provides resistance to heavy impact, sliding abrasive wear and thermal shock.

### ZAC / CORGUARD®

- highest impact resistant material with exceptional abrasion resistance, edge and fracture toughness
- interlocking grains and impervious structure provides high corrosion resistance to acid and acid bases
- largest shape capability in our portfolio

## MONOLITHIC CASTABLES

### WEARFRAX®

Silicon carbide and alumina based range of products that can be rammed/troweled/poured and primarily used to provide abrasion resistance in low and high temperature applications where traditional refractory bricks are either not feasible or cost effective.

### WEARFRAX® RS58L & RA57L

- easy preparation and installation
- no curing spray needed after installation
- 24 hour ambient temperature cure
- designed to withstand thermal shock

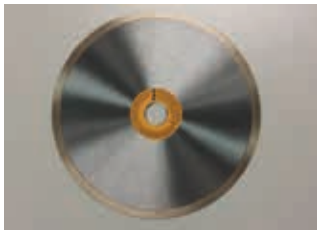
## ACCESSORIES

**WEARPAK®**

Adhesives, Mortar and Wearing compounds offered in various viscosity/grades to suit every application need.

**WEARFIX®**

A ZAC ceramic based wearing compound used to improve joint wear or as a filling material for improved performance.



**DIAMOND SAW BLADES**

Designed for easy on site jobs, offered in 8“, 10“, 14“ and 20“ dia.


**DIAMOND FLAP DISCS**

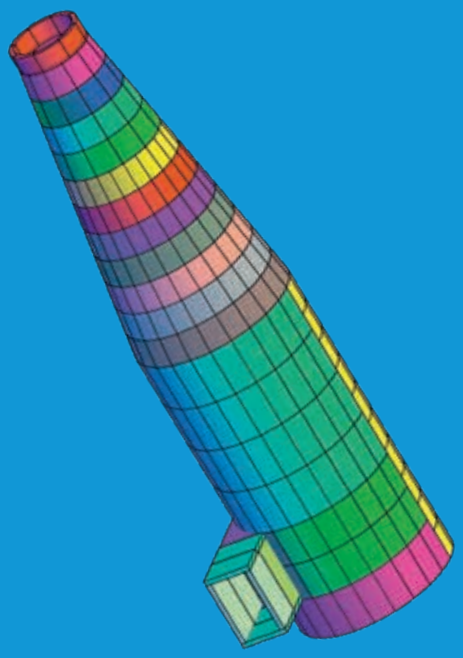
Diamond impregnated discs for fast removal, chamfering edges or smoothing surfaces wet or dry.

# OVERVIEW

| | Aluminum Oxide ($Al_2O_3$) | Silicon Carbide (SiC) | | | | | |
|---|---|---|---|---|---|---|---|
| | Alpha $Al_2O_3$ | Nitride Bonded SiC | | | | Reaction Bonded SiC | |
| | Durafrax® | Cryston® | Cryston® TW | Cast Refrax® 20 | Refrax® 20 | Norfrax® RB | Silit® SKD |
| **Properties** | | | | | | | |
| Density, g/cm³ | 3.52 | 2.77 | 2.77 | 2.77 | 2.62 | 3.05 | 3.00 |
| Porosity, % | 0 | 8 | <1 | 15 | 16 | 0 | 0 |
| Thermal Conductivity, W/m·K | 18 | 16.3 | 23.7 | 13.8 | 16.3 | 125 | 35 |
| Thermal Expansion, x10^-6/°C | 8.3 | 3.2 | 4.3 | | 4.7 | 4.3 | 4.5 |
| Vickers Hardness, Gpa | 9 | 23 | 11,6 | | | 22 | |
| Abrasion Resistance C704 | 1.0 | 1.6 | 1.5 | 1.9 | 2.5 | 0.7 | 0.7 |
| Max Use Temp, °C | 1250 | 1590 | 1450 | 1450 | 1590 | 1350 | 1380 |
| **Performance** | | | | | | | |
| Sliding Abrasion | Better | Good | Better | Good | Good | Better | Better |
| Erosion | Better | Good | Good | Good | Good | Better | Better |
| Impact | Good | Good | Good | Good | Good | Good | Good |
| Corrosion Resistance | Good | Good | Good | Good | Good | Better | Better |
| Thermal Shock | Good | Good | Better | Good | Good | Better | Better |
| Thermal Insulation | **Best** | **Best** | Better | **Best** | **Best** | Good | Good |
| Electrical Insulation | **Best** | Better | Better | Better | Better | Good | Good |

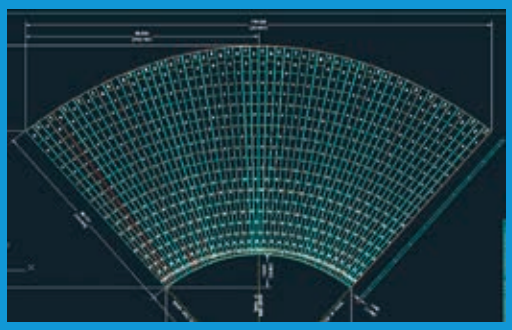
| | Silicon Carbide (SiC) | | Alumina Zirconia Silica | Castables | |
|---|---|---|---|---|---|
| | Reaction Bonded SiC | Sintered Alpha SiC | Fused Cast AZS | Silicon Carbide | Aluminum Oxide |
| | HAMMERfrax® | Hexoloy® | ZAC / Corguard® | Wearfrax® RS58L | Wearfrax® RA57L |
| **Properties** | | | | | |
| Density, g/cm³ | 3.04 | 3.10 | 3.49 | 2.45 | 2.80 |
| Porosity, % | 1 | 0 | 1.15 | | 15.5 |
| Thermal Conductivity, W/m·K | | 125,6 | | | |
| Thermal Expansion, x10^-6/°C | 4.3 | 4.02 | | | |
| Vickers Hardness, Gpa | 22 | | 19.6 | | |
| Abrasion Resistance C704 | 0.7 | 0.4 | 1.1 | 7.5 | 6.5 |
| Max Use Temp, °C | 1350 | 1900 | 1650 | 500 | 500 |
| **Performance** | | | | | |
| Sliding Abrasion | **Best** | **Best** | Good | Good | Good |
| Erosion | Better | **Best** | Better | Good | Good |
| Impact | Good | Good | **Best** | Good | Good |
| Corrosion Resistance | Better | **Best** | Better | Good | Good |
| Thermal Shock | Better | Good | Better | Good | Good |
| Thermal Insulation | Better | Good | **Best** | Better | Better |
| Electrical Insulation | Better | Good | Better | Better | Better |

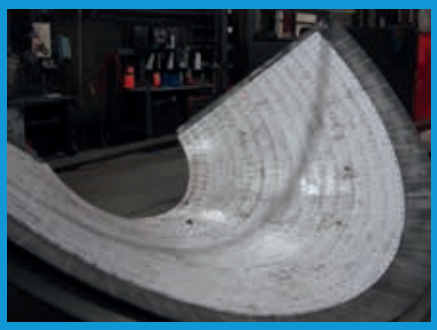
# PRE-ENGINEERED CERAMIC SOLUTIONS



Saint-Gobain Performance Ceramics & Refractories offers Pre-Engineered solutions for Wear Resistant applications.

Our solutions are developed with a deeper understanding of the customer's needs, tailor-made to fit accurate requirements through Research & Development, Engineering Design of shapes, Application Engineering, Installation and Analysis. These solutions are made possible with state-of-the-art manufacturing processes and techniques that enable us to produce geometries from simple to complex, thus resulting in enhancing the overall performance of wear resistance to meet every customer need.





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