SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

# WEAR RESISTANT TECHNOLOGIES

SAINT-GOBAIN

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2024

Derwent Top 100 Global Innovator 2024

Clarivate Analytics

top EMPLOYER Global 2025

FOR A BETTER WORLD OF WORK

**46.6**
in euro billion
2024 sales

**161,000**
employees

Represented in
**80**
countries

## WE ARE COMMITTED TO ACHIEVING NET ZERO CARBON EMISSIONS BY 2050

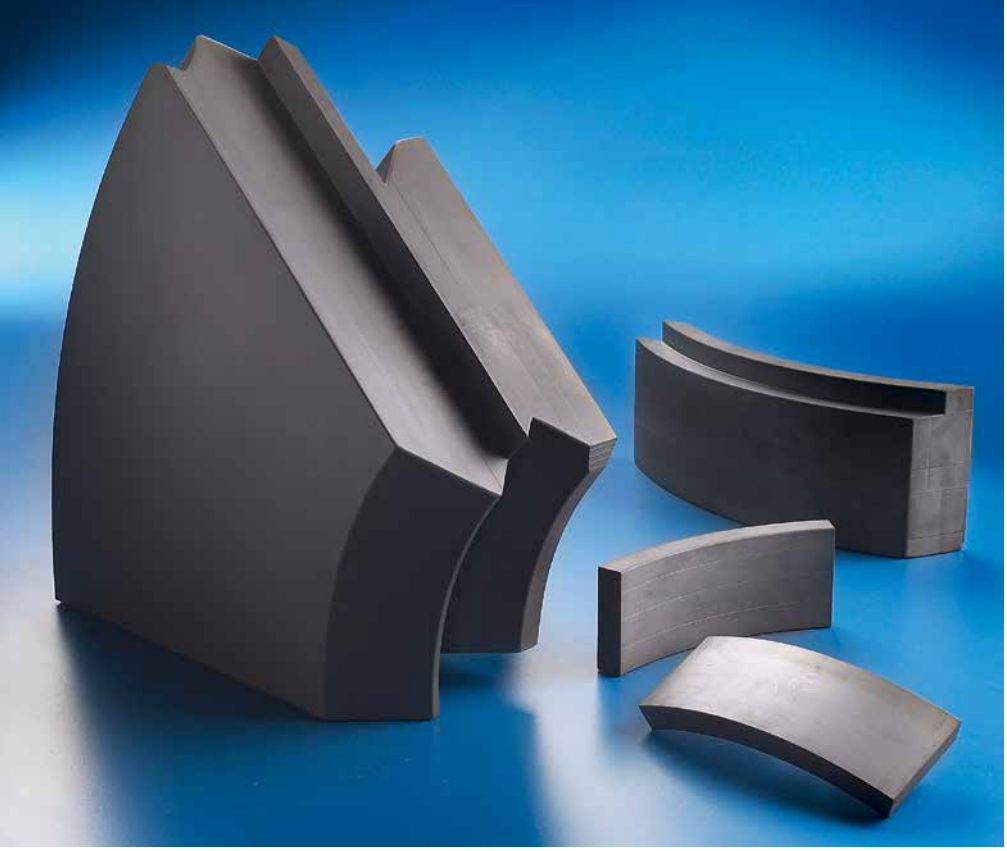
**1,100**
manufacturing facilities

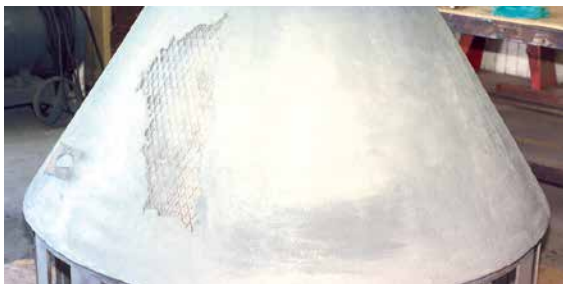
**-34 %**
Scope 1 & 2 $CO_2$ Emissions
(2024 vs. 2027)

**8**
main
R&D centers

# PIONEERING CERAMICS FOR A BETTER TOMORROW

SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES





# WEAR RESISTANT TECHNOLOGIES

Saint-Gobain's Wear Resistant products and solutions are developed with a focus on serving 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 know-how enables us to offer customized ceramic material solutions for various applications across a multitude of industries.

These solutions are applicable across a wide range of industries. A few of them are listed below.

# KEY MARKETS

- Iron Making
- Powder & Bulk Solids
- Aggregates
- Mining & Mineral Processing
- Grain Handling
- Asphalt
- Chemical Processing
- Cement
- Pulp & Paper
- Coal Fired Power
- Recycling
- Environment

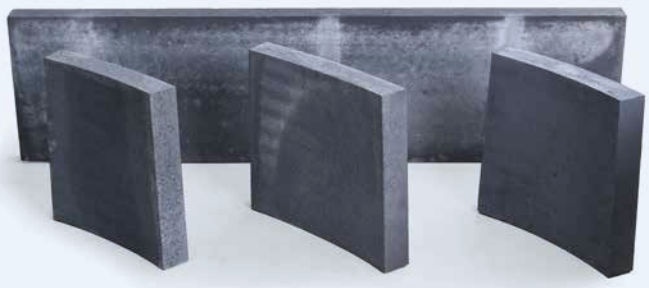
# ULTRA FINE SINTERED ALPHA-ALUMINA OXIDE ($AL_2O_3$)

Ultrafine-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 use in grain & food processing

# NITRIDE BONDED SILICON CARBIDE (NBSiC)



High performance dense NBSiC ceramic refractory with complex shape capabilities.

## CRYSTON® (max. 1590 °C) & CAST REFRAX® (max. 1450 °C) – Cast

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

## CRYSTON® TW – Cast

- improved wear and thermal-shock resistance compared to 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 molten 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.

- superior wear resistance compared to 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 acids and 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 not feasible or cost effective.

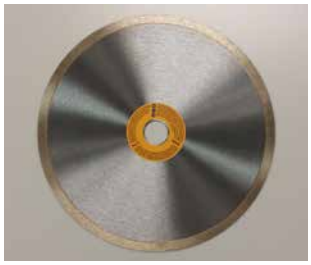
## WEARFRAX® RS58L & RA57L

- 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 viscosities and 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.



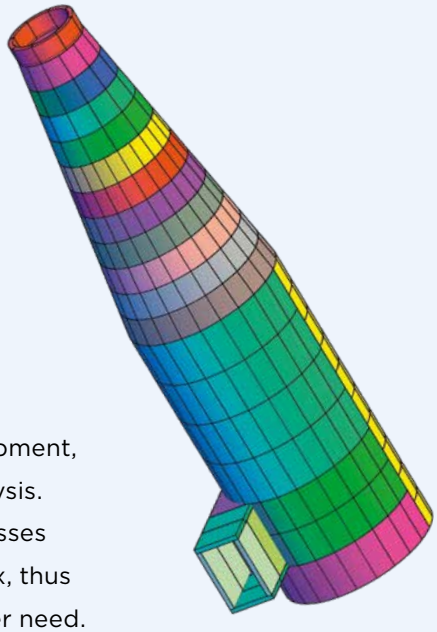
**Diamond Saw Blades**
Designed for easy on site jobs, offered in 8″, 10″, 14″ and 20″ dia.

**Diamond Flap Discs**
Diamond-impregnated discs for fast material removal, edge chamfering or surfaces smoothing, wet or dry.

| | 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 |

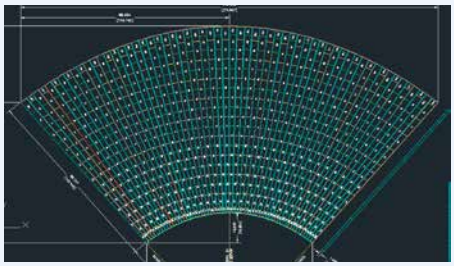
| | Silicon Carbide (SiC) | | Alumina Zirconia Silica | | Castables | |
|---|---|---|---|---|---|---|
| | Reaction Bonded SiC | Sintered Alpha SiC | Zirconia Toughned Alumina | Fused Cast AZS | Silicon Carbide | Aluminum Oxide |
| | HAMMERfrax® | Hexoloy® | Durastrike® ZTA | ZAC - Corguard® | Wearfrax® RS58 | Wearfrax® RA57 |
| **Properties** | | | | | | |
| Density, g/cm³ | 3.04 | 3.15 | 4.20 | 3.47 (RN) / 3.72 (RT) | 2.45 | 2.80 |
| Porosity, % | 1 | 2 | 0 | 1.15 (Skin) | - | - |
| Thermal Conductivity, W/m·K | 125 | 125,6 | - | - | - | - |
| Thermal Expansion, x10⁻⁶/°C | 4.3 | 4.02 | - | - | - | - |
| Vickers Hardness, Gpa | 22 | - | - | 19.6 | - | - |
| Abrasion Resistance C704 | 0.7 | 0.4 | 0.6 | 1.1 | 8.2 | 7.2 |
| Max Use Temp, °C | 1350 | 1900 | 1500 | 1650 | 500 | 500 |
| **Performance** | | | | | | |
| Sliding Abrasion | **Best** | **Best** | Good | Good | Good | Good |
| Erosion | Better | **Best** | Better | Good | Good | Good |
| Impact | Good | Good | **Best** | Better | Good | Good |
| Corrosion Resistance | Better | **Best** | Better | Better | Good | Good |
| Thermal Shock | Better | Good | Better | Better | Good | Good |
| Thermal Insulation | Better | Good | **Best** | Better | Better | Better |
| Electrical Insulation | Better | Good | Better | Better | Better | Better |

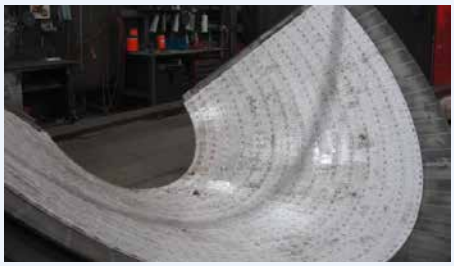
# PRE-ENGINEERED CERAMIC SOLUTIONS



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 meet precise 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 enhancing the overall performance of wear resistance to meet every customer need.





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