



SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

HEAT TREATMENT

REFRACTORIES FOR ATMOSPHERE FURNACES



HIGH PERFORMANCE REFRACTORIES

Saint-Gobain Performance Ceramics & Refractories (PCR) has been designing and manufacturing high performance refractories for demanding atmosphere furnaces for over 70 years. Our team of application engineers, material scientists and design engineers understand the conditions in atmosphere furnaces and can help you choose the correct material for your application.

Benefit from these advantages:

- Custom engineering to customer specifications
- Consistently high-quality manufacturing
- Extensive worldwide capacity
- Robust export compliance
- Manufacturing locations on multiple continents
- Global R&D resources

OUR SERVICES



DESIGN & ENGINEERING

Customized solutions including refractory drawings, adjusted design and modeling capabilities to help minimize maintenance/relining frequency.



INNOVATION

Research & development team stationed at our leading-edge R&D centers in Europe, North America and Asia; specialize in ceramic & refractory technology and constantly interact with customers & industry experts while using the most progressive and multidisciplinary technologies.



PARTNERSHIP

Experienced application teams offer assessments, working in partnership with customers to explore material science and shape capability available from a world leading refractory manufacturer.



CUSTOMER SUPPORT

Experienced, dedicated teams work closely with customers, either in person or remotely via the most advanced digital platforms.

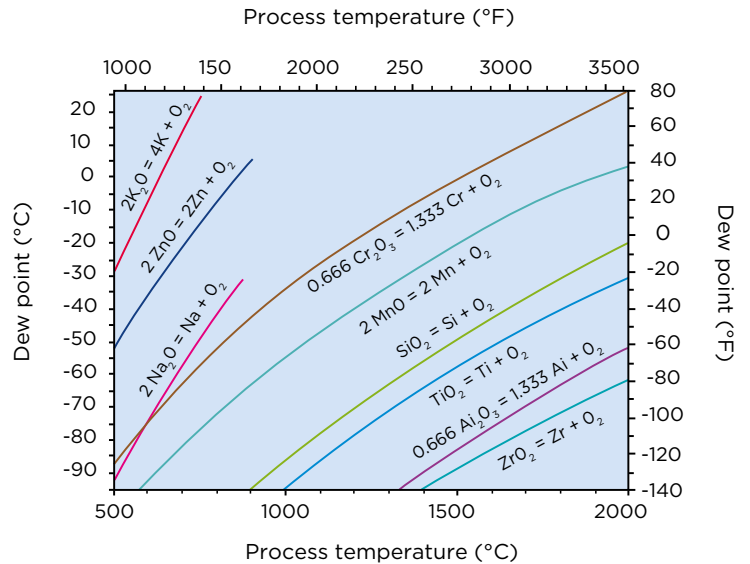


OUR MATERIALS DELIVER VALUE

Many of the metal oxides found in traditional refractories will reduce and reoxidize in cooler areas of the hydrogen atmosphere furnaces. This reaction is especially volatile in furnaces operating with low dew points. As a result it is important to understand this reaction when specifying furnace refractory and kiln furniture* (see oxide equilibria graph below). This reaction can lead to premature refractory repairs, inconsistent furnace operation and poor production yields. To avoid these costly and time consuming problems, it is important to select the correct refractories.

*Kiln furniture is synonymous with the refractory plates, batts, boats, setters, saggars, fixtures and specialty shapes used to support/ transport products during firing.

Metal-metal oxide equilibria in H₂-H₂O atmosphere at 1 ATM total pressure



OUR MATERIALS - YOUR BENEFITS

With over 125 years of experience with silicon carbide (SiC), today we leverage production capability in North America, Europe and Asia to support customers globally.

BENEFITS



Increased service-life



Reduced maintenance costs



Lower energy consumption



Optimum efficiency



Excellent creep resistance up to max. application of T = 1870°C

We provide ceramic materials designed to meet your needs:



QUALITY



EFFICIENCY



CUSTOM DESIGN

HYDROGEN ATMOSPHERE

Alundum® 99 furnace refractory should be specified in hydrogen atmosphere furnaces that operate from 1205 - 1870°C (2200 - 3400°F). This ultra-low silica content refractory will minimize or eliminate the contamination and degradation that results from the reduction and re-oxidation of silica, soda and potassium found in many refractory shapes.

* **AN199 & A299:** Less than 0.07% silica and 0.25% soda and potassium
AN599: Less than 0.05% silica, and 0.05% soda and potassium



MUFFLES

Alundum® 299 • Alfrax® 101 • AL100®

High purity alumina muffles are used to control firing conditions and to provide a stable, wear resistant support medium for resistance heated atmosphere pusher furnaces at temperatures up to 1870°C (3400°F).

- Designed to accommodate pusher plates
- Customized dimensions available

BRICKS

Alundum® 199 • Alundum® 599 • Alfrax® 101 • AL100®

Bricks can be safely used as part of a furnace lining up to 1760°C (3168°F). We also produce insulating and dense zirconia bricks for furnaces that operate up to 2200°C (4000°F)

- Produced brick shapes that support heavy loads
- Many brick shapes, including most industry standards available



HEARTH PLATES

Alundum® 199 • Alundum® 299 • Alfrax® 101 • AL100®

Hearth plates provide a long lasting, wear resistant push surface at temperatures up to 1870°C (3400°F).

- Excellent creep and sag resistance
- To maximize their life it is important to ensure they are properly supported

HIGH PURITY ALUMINA

BENEFITS



High strength dense alumina mixes*



Minimize contamination & degradation



Provide longlasting, durable, stable linings

HYDROGEN-NITROGEN ATMOSPHERE

Most traditional kaolin-based, silica rich, refractory brick and fiber can be used to insulate low temperature (1120°C, 2050°F) atmosphere (hydrogen-nitrogen) belt furnaces because these furnaces generally operate in atmospheres and at temperatures and dew points where silica is stable. These furnaces, which are used to sinter, braze and normalize P/M parts, typically incorporate silicon carbide (SiC) based structural furnace refractory.

SILICON CARBIDE

FEATURES & BENEFITS



Excellent creep resistance



Outstanding wear resistance



Superior thermal conductivity

BEAMS

Crystar® • Hexoloy® • N-Durance® • Silit® SK

SiC beams can be used as structural supports for ceramic and alloy muffles in belt furnaces.

- Produced in wide range of cross-sections, wall thickness and lengths (up to 4000 mm)
- Low mass
- Very high strength



For more information please visit our website to discover our entire kiln furniture portfolio.



MUFFLES/SKID RAILS

Carbofrax® • Mullfrax® • Refrax® • Zircofrax® AZS

Ceramic muffle sections can reduce the costs associated with the replacement of standard alloy muffles.

- Produced to accommodate belts
- Used in atmosphere belt furnaces that sinter traditional P/M parts
- Excellent creep and wear resistance

INNOVATION
REFRAX® TOP
DOUBLED FIRED SiC
with higher OXIDATION
RESISTANCE

CERAMIC RADIANT TUBES

Silit® SKD

The silicon carbide radiant tube offers higher productivity at lower energy consumption.

- Withstands application temperatures up to 1380°C / 2500°F
- Available for straight and single-ended applications
- Up to 3500 mm length and 300 mm diameter



DISCOVER OUR ENTIRE PRODUCT RANGE

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

| Family | TRADITIONAL SILICON CARBIDE | | | ADVANCED SILICON CARBIDE | | | |
|----------------------------------|---------------------------------------|---------------------------------------|-------------------------|--------------------------|-------------------------|--------------|--------------------|
| | Refrax® PLUS | Refrax® TOP | CARBOFRAX® A/M | N-DURANCE® | SILIT® SKD | HEXOLOY® SA | CRYSTAR® 2000 |
| SiC (%) | 75.0 | 75.0 | 86.0 | 70.0 | 85.0 | 98.0 | >99.0 |
| Composition (Phases) | Si ₃ N ₄ bonded | Si ₃ N ₄ bonded | SiO ₂ bonded | Nitride bonded SiC | Silicon Infiltrated SiC | Sintered SiC | Recrystallized SiC |
| Max. Application Temperature, °C | 1550 | 1150 | 1450 | 2642 | 1380 | 1900 | 1600 |
| Density, g/cc | 2.7 | 2.7 | 2.5 | 2.75 | 3.0 | 3.1 | 2.7 |
| Apparent Porosity, (%) | 14 | 12 | 18 | <1 | 0 | 15 | 15 |

| Family | HIGH PURITY ALUMINA | | | | | | |
|---|---------------------|-------------------|-------------------|------------------|------------------|---------------|----------------|
| | ALUNDUM® AN199 | ALUNDUM® AN299 | ALUNDUM® AN599 | AL100 | ALFRAX® 101 | MULLFRAX® 201 | ZIRCOFRAX® AZS |
| Alumina (%) SiO ₂ (%) Zirconia (%) | 99.5 0.07 - | 99.6 0.07 - | 99.8 0.05 - | 99.5 0.1 - | 98.7 0.1 - | 78 21 - | 52 17 30 |
| Composition (Phases) | Alumina | Alumina | Alumina | Fused Alumina | Fused Alumina | Fused Mullite | Zircon/Mullite |
| Max. Application Temperature, °C | 1870 | 1870 | 1760 | 1800 | 1800 | 1750 | 1700 |
| Density, g/cc | 3.2 | 3.2 | 1.6 | 3.3 | 3.0 | 2.6 | 3.0 |
| Apparent Porosity, (%) | 20 | 20 | 56 | 16 | 22 | 18 | 18 |



SAINT-GOBAIN



1 in 4 products
did not exist 5 years ago



167.000+
employees



sales of
€ 38.1 billion



represented in
70
countries



-12.2%
carbon emissions
reduction (base 2010)



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.



WE ARE COMMITTED TO BEING CARBON FREE 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.

GLOBAL PRESENCE



CONTACT US

NORTH & SOUTH AMERICA

Latrobe (USA)

+1 724 539 6000

Niagara Falls (USA)

+1 716 278 6233

Worcester (USA)

+1 508 795 5264

Vinhedo (Brazil)

+55 19 2127 8680

MIDDLE EAST & AFRICA

Dubai (UAE)

+971 4 8011 800

EUROPE

Castellón (Spain)

+34 964 7303 90

Cologne (Germany)

+49 9563 724 307

Corsico (Mi), (Italy)

+39 02 448 51

Prague (Czech Republic)

+420 606 607 224

Rainford (United Kindom)

+44 1744 88 2941

Rödental (Germany)

+49 9563 724 307

Vénissieux (France)

+33 4 78 78 13 79

INDIA

Bangalore

+91 80 284 7113 0

Halol

+91 722 8950 889

PACIFIC

Melbourne (Australia)

+61 394 745 940

JAPAN

Seto

+81 561 82 2485

Tokyo

+81 3 3263 0289

CHINA

Shanghai

+86 21 6489 9993

ASIA

Seoul (Korea)

+82 2 3706 9334

For more information: www.ceramicsrefractories.saint-gobain.com
ceramics.refractories@saint-gobain.com

Follow us on:

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PERFORMANCE CERAMICS & REFRACTORIES

