SAINT-GOBAIN PERFORMANCE CERAMICS & REFRACTORIES

CERAMIC SYSTEMS FOR KILNS & FURNACES

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SAINT-GOBAIN

SAINT-GOBAIN

Derwent Top 100 Global Innovator 2023

Clarivate Analytics

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.

Ceramic Systems

The products and solutions for kilns & furnaces under Saint-Gobain Ceramic Systems are designed and developed for many applications to have consistent and long-term performance.

Our products are designed to withstand high temperatures (up to 2500°C) and severe operating conditions.

Developed and manufactured to suit kilns & furnaces that are typically used in various industry segments.

Smart Design

In-depth understanding of customer application & processes, science, design engineering / mathematical modeling and R&D

+

Performing Products

Customized product design, shape & material for every application & industry, manufacturing & quality consistency

+

Your Partner

Worldwide sales & application team, installation supervision services, OEM collaboration, energy & emission assessment

KEY MARKETS & APPLICATIONS

WHITEWARE
SANITARY & DINNERWARE INDUSTRIES

ELECTRONICS & SEMICONDUCTOR
BATTERY / LI-ION

AUTOMOTIVE
HOT STAMPING, PARTICLE FILTERS, SPARK PLUGS, OXYGEN SENSORS

CHEMICAL
POWDER / PHARMACEUTICALS

TECHNICAL CERAMICS

ABRASIVES & GRINDING MEDIA

SANITARY & DINNERWARE

Our kiln furniture systems are designed and constructed of advanced silicon carbide (SiC) materials. Thinner, lighter and significantly stronger than traditional kiln furniture for meeting improved energy efficiencies in high temperature applications.

- Constructed of advanced silicon carbide
- Improved energy efficiencies
- Minimize mass
- Maximize strength
- Greater kiln capacity
- Reduced firing cycles

FEATURES

- Reduced energy consumption
- Optimum rate of capacity utilization
- High flexibility
- Excellent product quality
- Very good thermal shock behavior

LO-MASS® SYSTEMS

Up to **33%** higher efficiency

Crystar® • Hexoloy® SA • Hexoloy® SE • N-Durance® • Silit® SK • Silit® SKD

LO-MASS® components are customizable and flexible for whiteware and porcelain tableware firing systems.

Expertise in product design and customization for every type of kiln.

- Energy efficiencies in high temperature applications
- Minimize mass while maximizing strength
- Increased automation compatibility for loading and unloading

For more information

THINNER, LIGHTER, STRONGER

LAVI SETTER

PLATE SETTER
TRIO

PROFILE
BEAMS &
U-PROFILE
PLATE

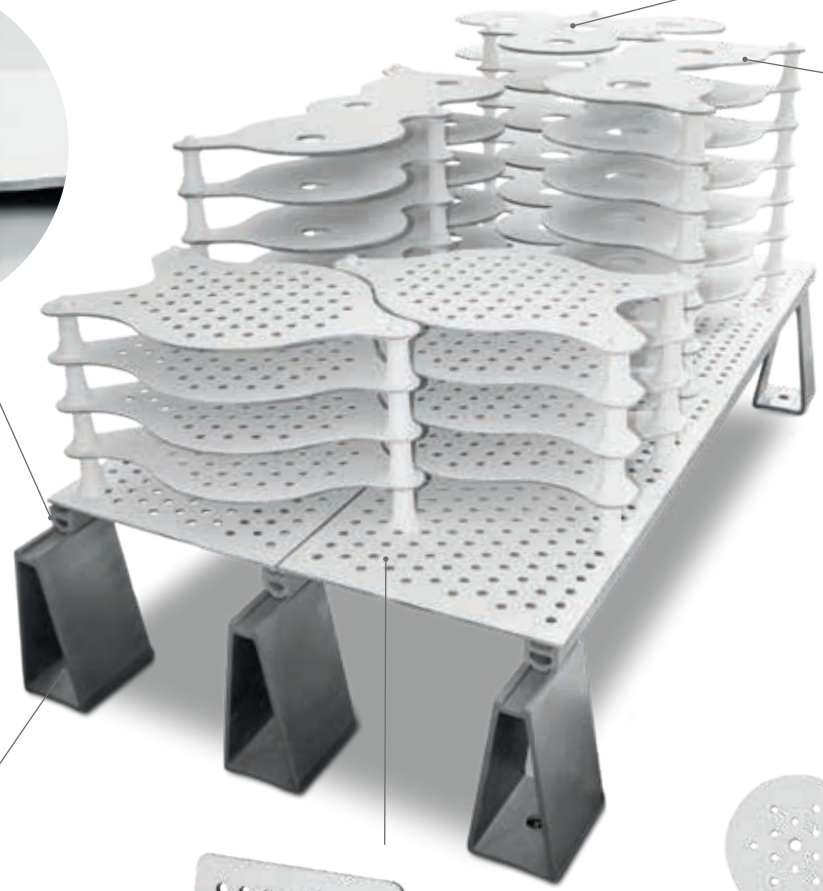


PLATE SETTER
DUO

PLATE SETTER
SINGLE

SUPPORTS

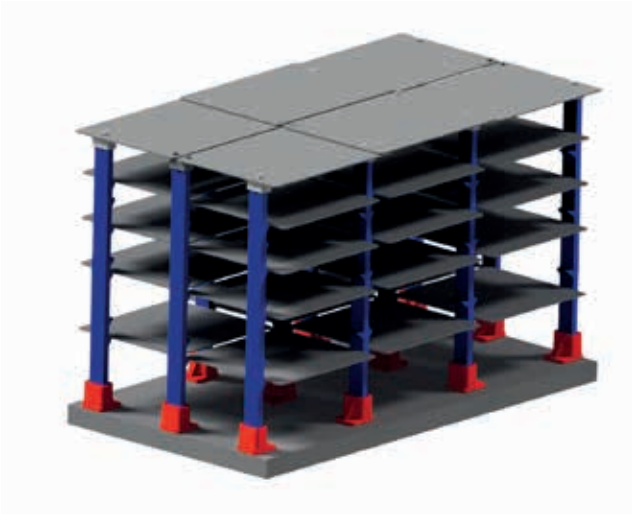
PLATES

PLATE SETTER
QUATTRO

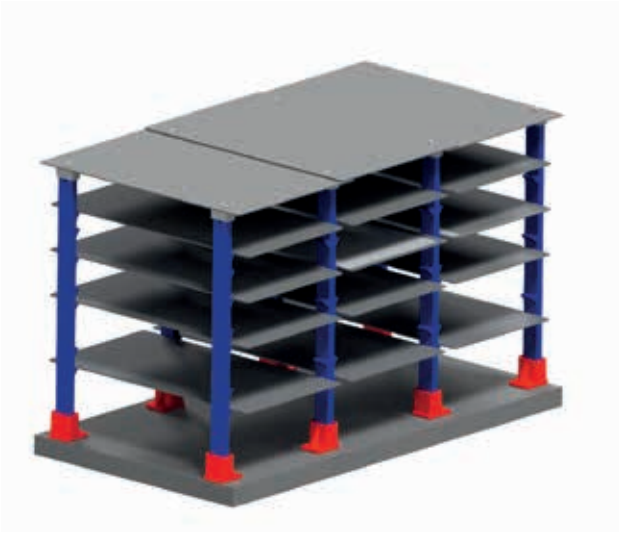
INNOVATION

In order to meet the constantly growing challenges of our customers, our innovative XXL plate size guarantees more products and less kiln furniture for your system. We offer this solution in the following key markets:

- Whiteware
- Automotive
- Technical Ceramics
- Abrasives & Grinding Media



SYSTEM WITH **STANDARD PLATES**



SYSTEM WITH **XXL PLATES**

(XXL) PLATES

N-Durance®

Many different **sizes possible**

Saint-Gobain offers individual designs that are available up to approximately 1250 x 900 x 10 mm (49 x 35 x .974“). They are approximately two times larger than other advanced silicon carbide plates currently offered on the market.

BENEFITS

- Increased setting space
- Further reduction of structural supports and kiln furniture
- Eliminate joints/seams underneath product
- Flatness retention over large setting area

LO-MASS® ULTRA

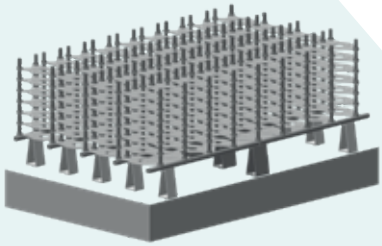
up to **40%** energy savings

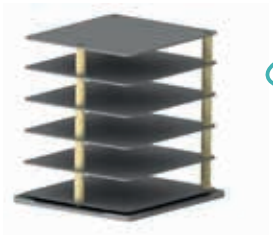
4MM PRODUCTS

Crystar® • N-Durance®

4 mm thick slabs and plate setters are available in a variety of shapes. They are manufactured with our industry proven N-Durance® and Crystar® advanced silicon carbide materials used in

- Porcelain, Dinnerware & Sanitaryware Industries
- Firing ceramic substrates for e.g. fuel cells





BENEFITS

- Faster heating & cooling cycles (fast firing kiln)
- >33% Weight mass reduction
- Increased productivity
- CO_2 Reduced CO_2 emissions
- Suitable for automated operations

≤ 2MM PRODUCTS

Crystar® • N-Durance®

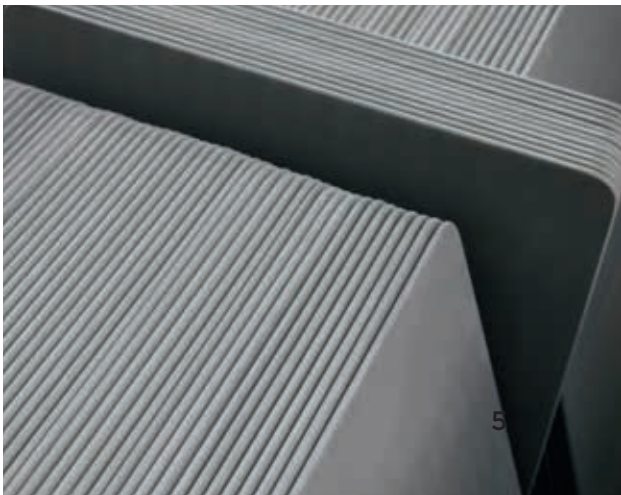
Saint-Gobain's innovative, Lo-Mass® Ultra slab systems are developed for highly flexible kiln furniture rack designs with sizes up to 200 mm x 250 mm and a **thickness down to 2 mm**.

This enables an optimal combination of product design, geometry and overall efficiency that is needed for

- Firing ceramic & composite substrates

BENEFITS

- CO_2 Energy savings & CO_2 reduction
- Increased productivity
- Improved life time (up to 1000 cycles)



AUTOMOTIVE

Our most trusted kiln furniture technology delivers increased productivity in manufacturing and processing various automobile components while reducing energy consumption. Our design services are key to optimizing individual requirements.

FEATURES

- Excellent thermal conductivity
- Shape stability and strength
- Outstanding thermal shock behavior
- Defined flatness and surface finish

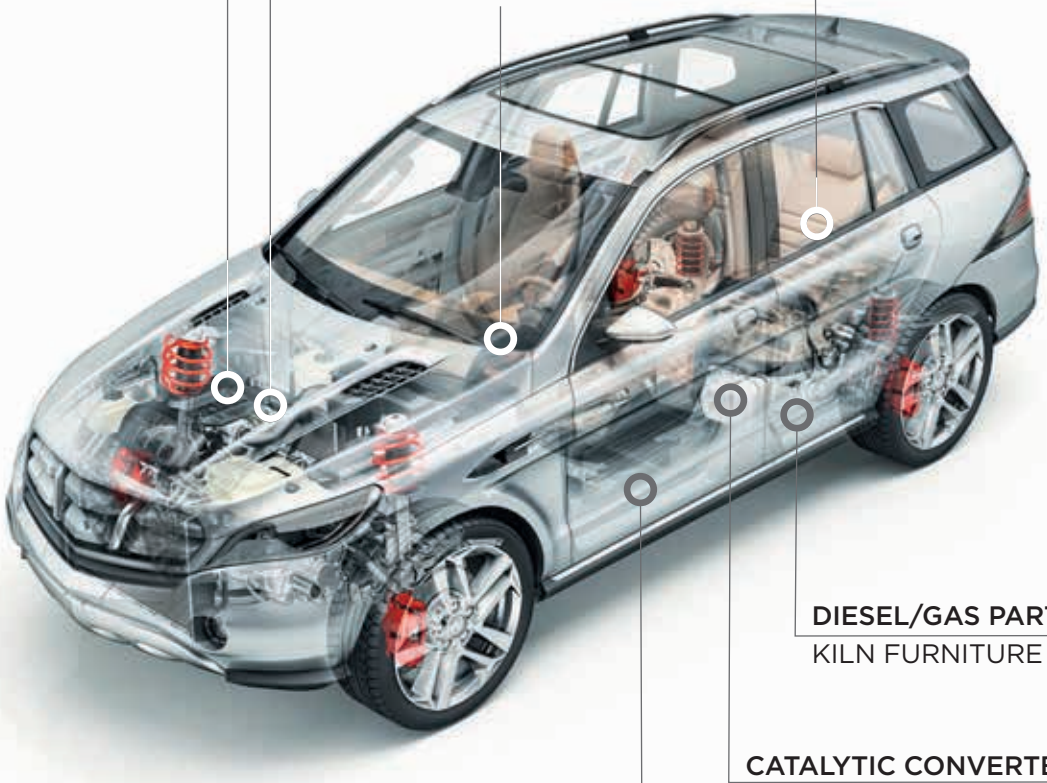
OXYGEN SENSORS
SAGGERS

SPARK PLUGS
SAGGERS

ANTI-LOCK BRAKING SYSTEMS
WAFFLE SLABS

ELECTRONIC STABILITY PROGRAMS
WAFFLE SLABS

CHASSIS COMPONENTS
HOT STAMPING ROLLERS



DIESEL/GAS PARTICLE FILTERS
KILN FURNITURE ASSEMBLIES

CATALYTIC CONVERTERS
KILN FURNITURE ASSEMBLIES

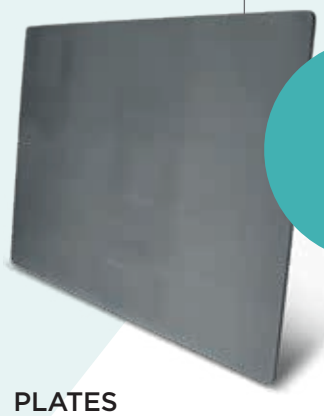
EV BATTERY POWDER
ROLLERS & SAGGERS

For more information

KILN FURNITURE ASSEMBLIES

Our most trusted material technology delivers increased productivity for DPF & GPF, filters and substrate manufacturing while reducing energy consumption.

Customers have always benefited from our design services as it is optimized to individual requirement.



up to **40%** energy savings*

POSTS

Silit® SKD • N-Durance®
Crystar®

ROLLERS

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

BEAMS & PROFILE BEAMS

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

SUPPORTS

Alundum® • AnnaCarbid® • Cryston®
AnnaSicon® • Silit® SK • Silit® SKD
N-Durance® • Crystar® • Hexoloy® SE

PLATES

Alundum® • AnnaCarbid® • AnnaMullit® • AnnaSicon® • Cryston®
Mulnorite® • Mullfrax® • Silit® SK • Silit® SKD • N-Durance® • Crystar®
Hexoloy® SE

*Lo-Mass® ULTRA plates on page 5

CERAMIC ROLLERS FOR HOT STAMPING APPLICATIONS

DuraFORM®

Our ceramic rollers offer distinctive mechanical, thermal and corrosion resistant characteristics, which makes them best in class and delivers unmatched benefits.

For steel hardening and hot forming processes, our hot stamping rollers are the best solution for your roller hearth kiln challenges. They provide longer life and require less maintenance.

BENEFITS

- Significant longer life time
- No breakage
- No diffusion into the roller material
- Easy removable contaminations
- Reduced maintenance needs

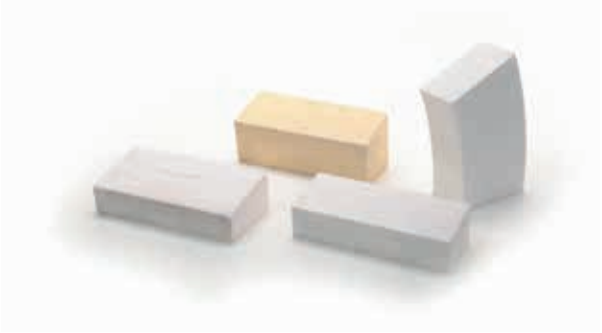
SiC rollers after 12 months – Superficial contamination with no penetration into the body

REFRACTORY SHAPES

Our innovative materials offer high temperature stability, thermal shock and corrosion resistance along with other application tailored properties.

REFRACTORY BRICK LININGS

Alundum® • Alfrax® • AL100 • AnnaMullit® • Mullfrax®
Mulnorite® • RI34 • Zirnorite®



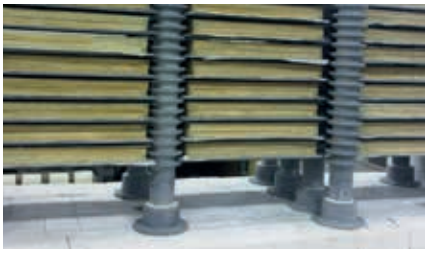
High alumina, mullite and zirconia brick linings for high temperature kilns and atmosphere furnaces ensure optimal thermal processing.

Our engineered ceramics provide solutions for the production of technical (fine) ceramics in highly specialized and diverse applications. We help our customers to produce technical ceramics with unique mechanical, electrical, thermal and chemical properties and property combinations.

We offer a large selection of silicon carbide, high purity alumina, high alumina-mullite, mullite, zirconia refractory and kiln furniture products.

BENEFITS

- High temperature stability and strength
- Excellent thermal shock resistance
- Optimum rate of capacity utilization
- Chemical compatibility
- Superior size capability



THE ALUMINA ADVANTAGE

Complex shape capacity reduces costs & set-up time

Saint-Gobain Performance Ceramics & Refractories high-purity ALUNDUM® and ALFRAX® furnace refractory systems provide stable, long-lasting performance in hydrogen atmosphere furnaces and gas-fired periodic kilns.

Our high-purity alumina formulations remain stable in the driest high-temperature furnaces, operating between 1205°C – 1870°C (2200°F – 3400°F).

HIGH PURITY ALUMINA

BENEFITS

- High strength dense alumina mixes*
- Minimize contamination & degradation
- Provide longlasting, durable, stable linings

MUFFLES

Alundum® • Alfrax® • 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).

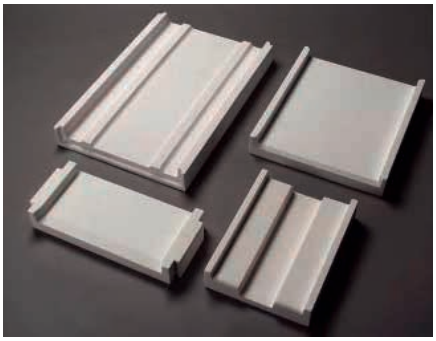
- Designed to accommodate pusher plates
- Customized dimensions available

BRICKS

Alundum® • Alfrax® 101 • AL100 • RI34

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)

- Brick shapes that support heavy loads
- Industry standard and specialty shaped brick available



HEARTH PLATES

Alundum® • 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
- For maximum plate life it is important that hearth plates are properly supported

ELECTRONICS & SEMICONDUCTOR

KILN FURNITURE

Advancer® • Alundum® • Alfrax® • AnnaMullit®
Crystar® • Hexoloy® • Zirnorite®

Engineered ceramics are used in the production of electronic ceramics, including alumina substrates, capacitors, ferrites, titanates, glass, quartz and crystals.

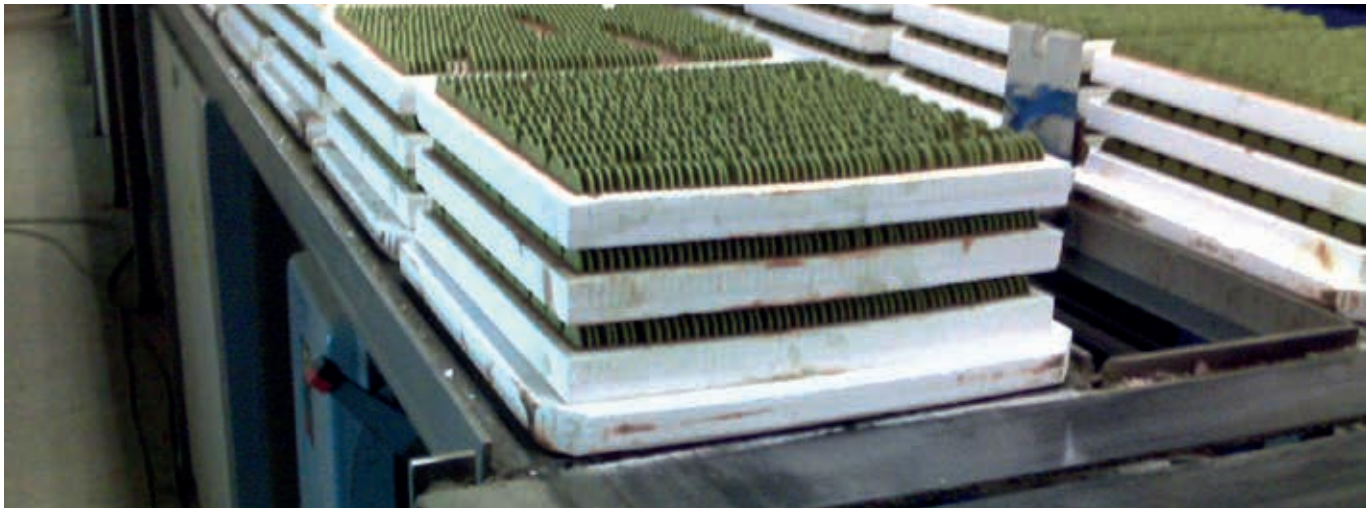
Wether nitride bonded, sintered or recrystallized silicon carbide, it is used in the production of semiconductor components and sputtering targets. Our complete product range extends to alumina/mullite and zirconia kiln furniture.

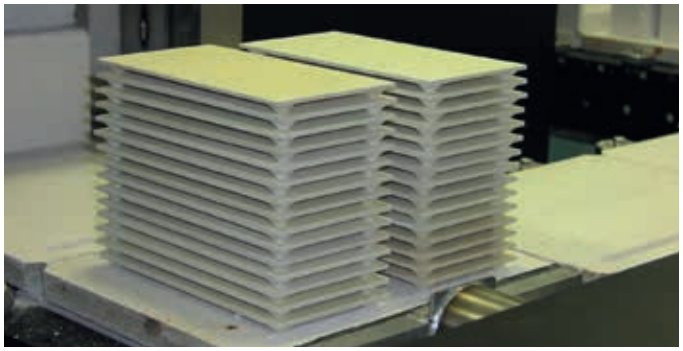
Engineered Ceramics for electronic ceramics:

- Titanates
- Glass
- Quartz
- Crystals
- Ferrites
- Capacitors
- Substrates
- Insulators
- Varistors

BENEFITS

- Chemical compatibility
- High stability and strength
- Excellent thermal shock resistance
- Outstanding thermal conductivity
- High productivity
- Superior size capability





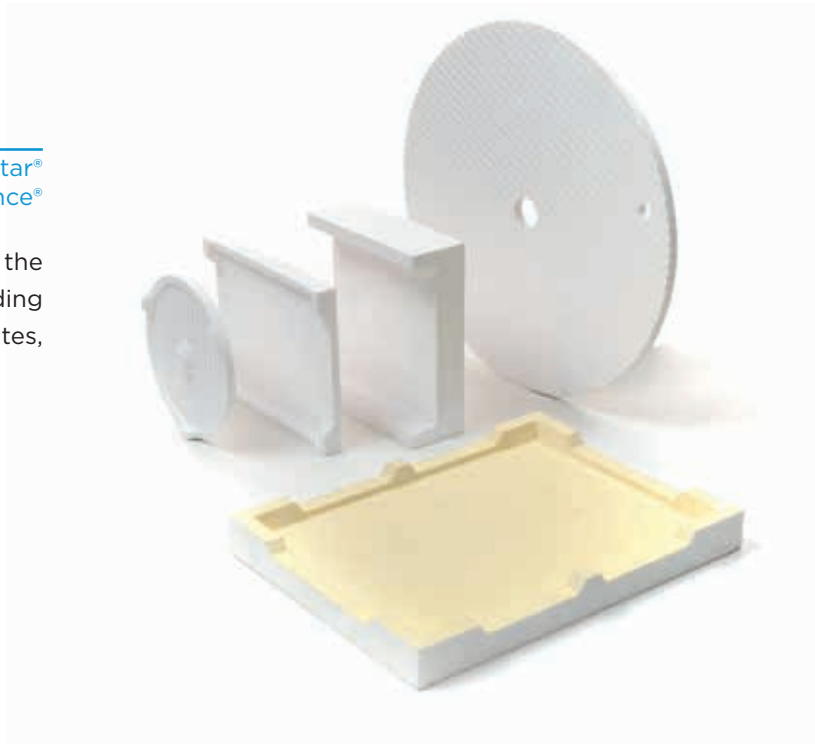
ELECTRONICS & SEMICONDUCTOR

SETTERS

Alundum® • Alfrax® • AnnaMullit® • Crystar® N-Durance®

Our engineered ceramics are used in the production of electronic ceramics, including alumina substrates, capacitors, ferrites, titanates, glass, quartz and crystals.

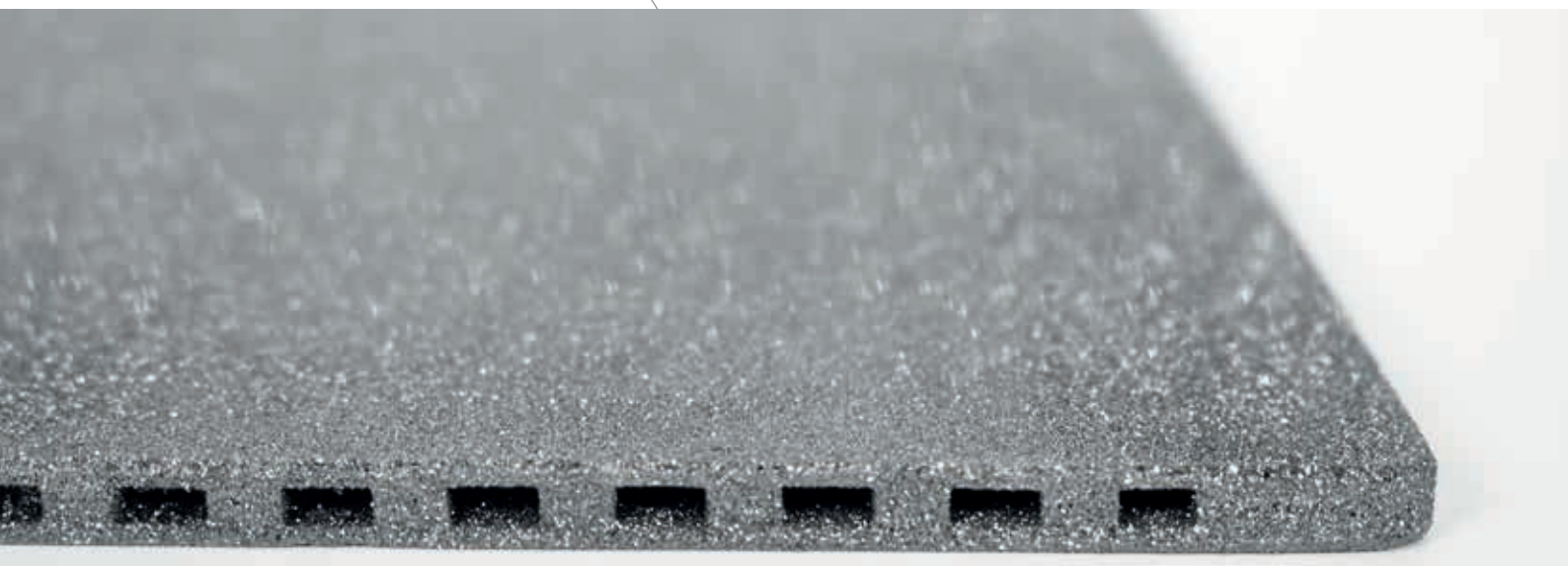
- Excellent thermal shock resistance
- Shape stability and strength
- Defined flatness and surface finish



WAFFLE SLABS

Crystar®

- Porous material
- Enables stable de-binding
- Maintains high stability and strength



PIGMENTS & POWDERS

Our ability to manufacture a wide range of silicon carbide, alumina and mullite products caters to a wide spectrum of powder and pigment types and processes.

- **ROLLERS** and **SAGGERS** for processing lithium-ion battery cathode powders
- **KILN FURNITURE** and **REFRACTORY** for processing powder metal (PM) and metal injection molded (MIM) parts in atmosphere furnaces
- Various material selections during firing process of different pigments and powder types for the best performance

FEATURES

- High stability and strength
- Excellent thermal conductivity
- Extended life time
- Very good chemical resistance
- Outstanding thermal shock resistance

FIRING, SINTERING, HEAT TREATING

ROLLERS

Hexoloy® SE • Silit® SK

- Up to 4000 mm length and 70 mm diameter*
- Outstanding chemical resistance
- Reduced maintenance requirements

SAGGERS

Alundum® • AnnaCarbid® • AnnaMullit® • AnnaSicon® RTH
Cryston® • Crystar® • Mullfrax® • Mulnorite® • N-Durance®
Silit® SKD

- Various materials and shapes available
- High temperature stability
- Defined flatness, shape stability and strength

*Other dimensions on request.

Greater kiln capacity & reduced firing cycles

MATERIAL CHOICES

Our kiln furniture systems are designed and constructed of advanced silicon carbide (SiC) materials.

Thinner, lighter and significantly stronger than traditional kiln furniture for meeting improved energy efficiencies in high temperature applications - minimize mass while maximizing strength.

We can provide traditional SiC as well as advanced SiC with LO-MASS® kiln furniture benefits.

FEATURES & BENEFITS

TRADITIONAL SiC

- High shape stability and creep resistance
- Very good thermal conductivity
- Excellent thermal shock resistance
- High oxidation resistance

ADVANCED SiC LO-MASS®

- Reduced energy consumption
- Optimum rate of capacity utilization
- High flexibility
- Excellent product quality
- Very good thermal shock behavior

PLATES /BATTS

Alundum® • AnnaMullit ® • Cryston® CN790
Carbofrax® A • Crystar® • Refrax® • Silit® SK
Silit® SKD • N-Durance® • Hexoloy® SE

Saint-Gobain offers a wide range of sizes for plates or batts. To find the best solution for your system, please speak to our experienced engineers. They understand your needs and will help you make the right product selection for your application.

ENGINEERED CERAMICS

Horizontal tempering of large glass plates for flat screens or glass ceramic cooktops. For roller hearth kilns, high temperature zones are predominantly equipped with silicon carbide rollers.
Co-development of innovative muffles that have steadily increased the size and quality of LCD display glass.

BENEFITS

- Excellent thermal conductivity
- High strength and shape stability
- No deformation over the whole temperature range
- Outstanding temperature stability

© ONEJOON GmbH

ZIRCONIA PRODUCTS

Zirnorite®

- Calcia and yttria stabilized zirconia brick and shapes
- Dense and insulating
- For extreme high temperature applications

ROLLERS

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

- Shape stability
- Long lengths, different diameters available
- Tight tolerances in MD and TIR

PERFORMANCE CERAMICS & REFRACTORIES

Saint-Gobain Performance Ceramics & Refractories has been designing and manufacturing high performance ceramics & refractories 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

Tailor-made materials & solutions

DESIGN & ENGINEERING

Customized solutions including ceramic & 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 ceramic & refractory manufacturer.

CUSTOMER SUPPORT

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

MAKING THE WORLD A BETTER HOME

OUR COMMITMENT
Being carbon free by 2050

OUR AMBITION
To provide solutions to our customers that contribute to de-carbonization and reduce environmental footprint.

SUSTAINABILITY AT THE HEART OF OUR BUSINESS STRATEGY
Sustainability is a key tenet of modern environmental, social, and corporate governance (ESG).

At Saint-Gobain Performance Ceramics and Refractories, our business model directly contributes to critical ESG outcomes with a dual approach to sustainable development goals: **Minimizing our environmental footprint while maximizing our virtuous impact across the entire value chain.**

OUR 2030 OBJECTIVES

WATER

- **- 50%** Industrial water withdrawal
- **0** water discharge in area with extremely high water risk

CO_2 EMISSIONS

- **- 33%** reduction in scope 1 and scope 2 emissions
- **- 16%** reduction in scope 3 emissions

CIRCULAR ECONOMY

- **- 80%** non valorized production residue
- **+ 30%** avoidance of virgin raw material
- **100%** recyclable packaging with 30% recycled or bio-sourced content

PRODUCT STEWARDSHIP

- **100%** Life Cycle Analysis for all of Group product ranges

MATERIAL PROPERTIES

TYPICAL VALUES

Alumina based

Properties	Unit	Alundum®				
		AH191A	AH199B	AH291	AH299A	AN599B
Alumina	%	91.3	99.55	91.3	99.55	99.8
Silica	%	8.5	0.07	8.5	0.07	0.05
Max. service temperature[1]	°C	1750	1870	1750	1870	1760
Bulk density	g/cc	2.9	3.25	2.9	3.2	1.6
Apparent porosity	Vol. %	20	18	20	19	56
Modulus of rupture 1250°C	MPa	11.03	17.93	8.96	12.41	0.31
Modulus of Elasticity RT[2]	GPa	34	117	30	135	22
Thermal Conductivity 1200°C	W/(mK)	2.85	4.3	2.6	2.3	1.45
Thermal expansion $\alpha_{RT...1100°C}$	10^{-6}/K	7	8.4	7	8.4	8.7

Properties	Unit	Alundex®		Alfrax® B201	AnnaMullit®		Mulnorite® KN 176	Mullfrax® EM 27
		AX796	AX797	AH723	83 (sagger/plate)	88 (sagger/plate)		
Alumina	%	91.2	91.2	88.4	86/84	82/82	82	90
Silica	%	8.6	8.6	11.5	13/15	17/17	-	-
Max. service temperature[1]	°C	1800	1800	1815	1500	1750	1700	1750
Bulk density	g/cc	2.9	2.9	1.6	2.65/2.8	2.65/2.75	2.7	3
Apparent porosity	Vol. %	19	18	54	22/17	19/16	17	17
Modulus of rupture 1250°C	MPa	16.4	14.7	5.5	11/10[3]	10/10[3]	5[3]	8[3]
Modulus of Elasticity RT[2]	GPa	16	17.8	11	36/27	36/37	34	16
Thermal Conductivity 1200°C	W/(mK)	3.22	3.41	1.36	1.6	1.7	1.6	1.7
Thermal expansion $\alpha_{RT...1100°C}$	10^{-6}/K	6.7	6.4	7.3	6.1	5.3	5.3	-

1) Dependent on the corresponding operation conditions 2) Ambient temperature 3) @1400°C

MATERIAL PROPERTIES

TYPICAL VALUES

Silicon Carbide based

Properties		Unit	AnnaCarbid®			AnnaSicon® 25	Carbofrax®	Cryston®
			42	65	94		CN 764	CN790
SiC-content		%	40	65	84	75	90	81
Max. service temperature[1]		°C	1430	1450	1500	1650	1500	1590
Bulk density		kg/dm³	2.5	2.5	2.5	2.63	2.57	2.68
Apparent porosity		Vol. %	20	21	17	17	9.8	13
Modulus of rupture	RT[2]	GPa	20	15	20	40	15.8	46
	1400°C	GPa	10	15	20	35	24.4[3]	41[3]
Thermal expansion $\alpha_{RT...1100°C}$		x10⁻⁶/K	5	5	5	4.5	4.7	5.0

Properties		Unit	AnnaSicon® RTH	Silit®		N-Durance®	Crystar®		Hexoloy®	
				SK	SKD		2000	3000	SA	SE
SiC-content		%	70	85	85	70	> 99	> 97	> 99	>98
Max. service temperature[1]		°C	1450	1380	1380	1450	1600	1600	1750	1750
Bulk density		kg/dm³	2.8	3	3	2.75	2.7	2.7	3.07	3.05
Apparent porosity		Vol. %	< 1	0	0	≤ 1	15	15	< 0.6	5.1
Modulus of rupture	RT[2]	GPa	160	260	260	170 – 180	80	80	380	280
	1400°C	GPa	180	260	260	170 – 190	90	90	370	270
Thermal expansion $\alpha_{RT...1100°C}$		x10⁻⁶/K	4.4	4.5	4.5	4.4	4.8	4.8	4.02	4.02

Zirconia based

Properties		Unit	Zirnorite®			
			ZH192	ZH292A	ZS699	ZS730
ZrO_2-content		%	92.66	92.66	85.55[4]	85.55[4]
Y_2O_2-content		%	-	-	14.00	14.00
CaO-content		%	4.53	4.53	0.10	0.10
Max. service temperature[1]		°C	2200	1650	2500	2500
Bulk density		kg/dm³	4.43	3.82	4.70	4.73
Apparent porosity		Vol. %	22	32	21	21
Modulus of rupture	RT[2]	GPa	12.02	9.80	17.78	27.89
	1450°C	GPa	0.57	1.25	12.56[5]	10.99
Thermal expansion $\alpha_{RT...1100°C}$		x10⁻⁶/K	9.10	9.10	10.60	10.60

1) Dependent on the corresponding operation conditions 2) Ambient temperature 3) @1450°C 4) ZrO_2 + HfO_2-content 5) @1250°C

STANDARD DIMENSIONS FOR BEAMS

Below listed dimensions cover the majority of standard sizes. Larger sizes and tighter tolerances on request.

Feasible dimensions and tolerances of **SILIT® SK** beams*:

Dimensions		Tolerance X mm	Wall Thickness s +1/-0.5 mm	Max Length ± 2 mm
Height H ± X mm	Width B ± X mm			
20	20	± 1.0	6	2000
25	25	± 1.0	6	2000
30	20	± 1.0	6	2000
30	30	± 1.0	6	2000
35	35	± 1.0	6	2000
40	20	± 1.0	6	2000
40	25	± 1.0	6	2000
40	30	± 1.0	6	3000
40	40	± 1.0	6	3500
50	30	± 1.0	6	3500
50	40	± 1.0	6,3	3500
50	50	± 1.0	6,3	3500
60	40	± 1.2	6,8	3500
60	50	± 1.2	6,8	3500
60	60	± 1.2	7,3	3500
70	40	± 1.4	7,5	3500
70	50	± 1.4	7,5	3500
70	60	± 1.4	7,5	3500
80	40	± 1.4	8	3500
80	60	± 1.4	8,5	3500
80	80	± 1.4	9	3500

Maximum deflection MD and side deflection SD of **SILIT® SK** beams:

Length [mm]	MD [mm]	SD [mm]
≤ 2000	≤ 2	≤ 3
≤ 2500	≤ 3	≤ 5
≤ 3000	≤ 5	≤ 8
≤ 3650	≤ 7	≤ 9

Feasible dimensions and tolerances of **N-Durance®** beams*:

Dimensions		Wall Thickness s +3/-0.5 mm	Max Length ± 2 mm
Height H ± 1.5 mm	Width B ± 1.5 mm		
20	20	4	1300
30-40	20-30	5	2000
40-80	40-50	6	3200
80-110	50-80	7	3200

Maximum deflection in relation to the length is 2‰.

Feasible dimensions and tolerances of **CRYSTAR®** beams*:

Dimensions		Wall Thickness s +3/-0.5 mm	Max Length ± 2 mm
Height H ± 1.5 mm	Width B ± 1.5 mm		
20	20	4	2000
20-40	20-30	5	2000
40-80	30-50	6	2000
80-110	40-60	8	3000
110-270	40-80	10 +5/-0.5	3000

Maximum deflection in relation to the length is 2‰.

*Technical data, right of modification reserved.

STANDARD DIMENSIONS FOR TUBES & ROLLERS

Below listed dimensions cover the majority of standard sizes. Larger sizes and tighter tolerances on request.

Feasible dimensions and tolerances of **SILIT® SK** tubes & rollers*

Diameter				Max Length ± 2 mm
Outside D [mm]		Inside d [mm]		
20	± 0.3	11	+0.35/-1.55	2500
20	± 0.3	13	+0.35/-1.55	2500
25	± 0.3	15	+0.4/-1.6	2500
25	± 0.3	18	+0.4/-1.6	2500
30	± 0.4	21	+0.45/-1.65	3000
31.7	± 0.4	22.5	+0.5/-1.7	3000
34	± 0.4	24	+0.5/-1.7	3500
35.5	± 0.5	25	+0.5/-1.7	3500
38.1	± 0.5	27.8	+0.55/-1.75	3500
40	± 0.5	30	+0.55/-1.75	3500
42	± 0.5	32	+0.55/-1.75	3500
45	± 0.6	34	+0.7/-1.8	3500
50.8	± 0.6	38.1	+0.65/-1.85	3500
55	± 0.9	43	+0.7/-1.9	3500
60	± 1.0	47	+0.8/-2	3500
63.5	± 1.2	50.8	+0.9/-2.1	3500
65	± 1.2	52	+0.9/-2.1	3500
70	± 1.2	56	+1/-2.2	3000
76	± 1.4	60	+1/-2.2	3000
80	± 1.4	65	+1.2/-2.4	3000
90	± 1.6	76	+1.4/-2.6	3000

Maximum deflection MD of **SILIT® SK** tubes & rollers:

Length [mm]	MD [mm]
≤ 2000	≤ 5
≤ 3500	≤ 7
> 3500	≤ 3 ‰

Feasible dimensions and tolerances of **N-Durance®** tubes & rollers*:

	Outer Diameter [mm]	Wall Thickness [mm]	Max Length [mm]
	-20	4	1000
	21-30	5	2500
	31-40	5	2800
	41-50	5	3000
	51-100	6	3000
Tolerance	**-2**	**-6**	**±2**

Maximum deflection MD of **N-Durance®** tubes & rollers:

Length [mm]	MD [mm]
≤ 2000	≤ 5
2001-3000	≤ 7

*Technical data, right of modification reserved.

Feasible dimensions and tolerances of **CRYSTAR®** tubes & rollers*:

	Outer Diameter [mm]	Wall Thickness [mm]	Max Length [mm]
	-20	4	1000
	21-30	5	2500
	31-40	5	2800
	41-50	5	3000
	51-60	6	3000
	61-70	6	3000
	71-80	6	3000
	81-90	6	3000
	91-100	6	3000
Tolerance	**+1/-0,5**	**+3/-0,5**	**±2**

Maximum deflection MD of **CRYSTAR®** tubes & rollers:

Length [mm]	MD [mm]
≤ 2000	≤ 5
2001-3000	≤ 7

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