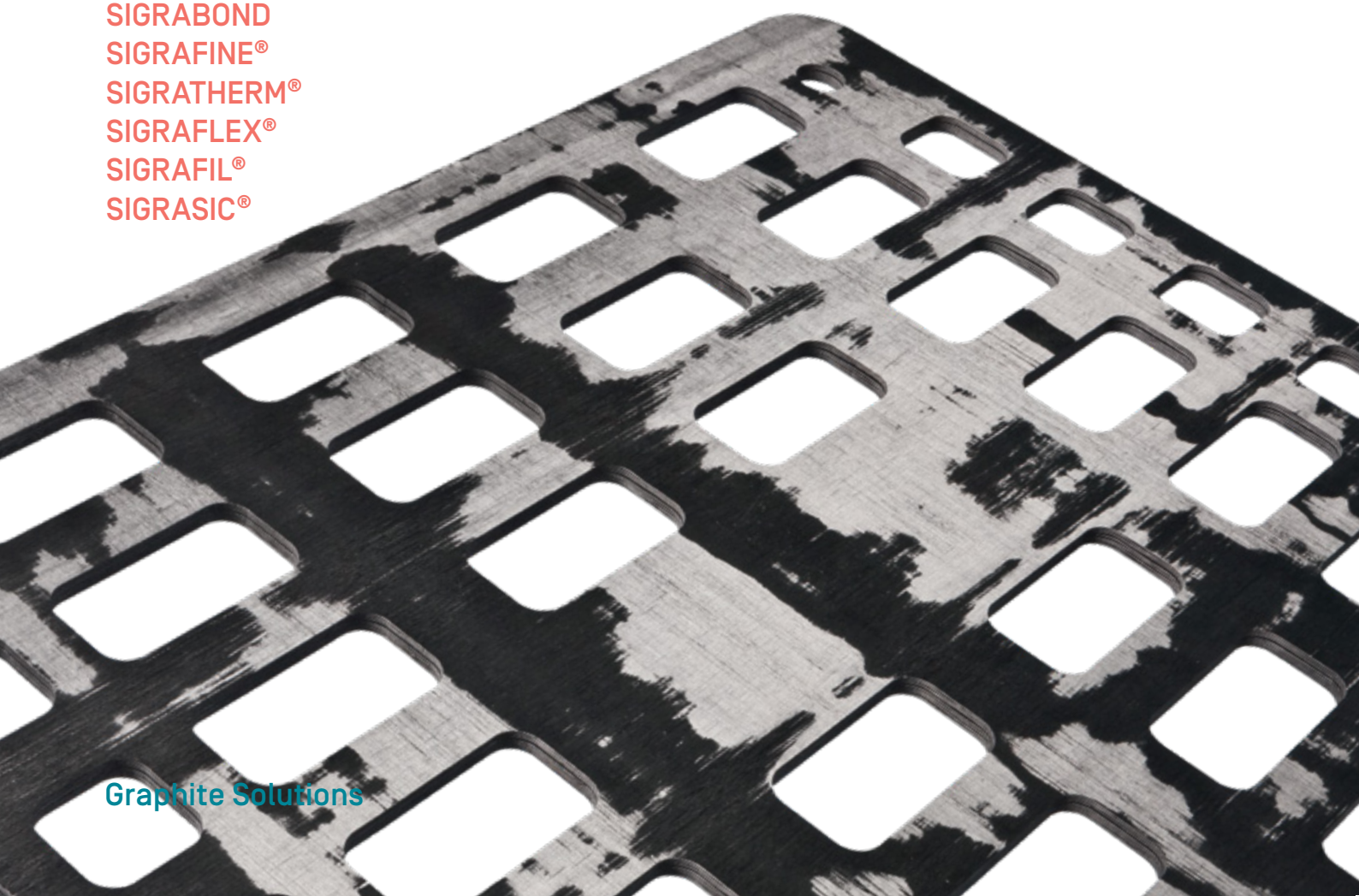
sgl carbon

The Performancers

Our specialty graphites for high-temperature furnaces

SIGRABOND
SIGRAFINE®
SIGRATHERM®
SIGRAFLEX®
SIGRAFIL®
SIGRASIC®



Graphite Solutions

SIGRATHERM® GFA
We know heat

Increased requirements for product characteristics are changing manufacturing processes. Temperatures of up to 3000 °C are needed in numerous industries – a challenge for the components in the furnaces used.

We developed soft graphite felt for insulation, which is capable of reliably withstanding these temperatures. As the leading manufacturer of graphite, we have the systems and know-how for high-temperature processes of this kind. We provide high-quality materials and components for high-temperatures and increased performance and quality in the products produced – true performancers.

0°C

Our specialty graphites for high-temperature furnaces

We provide high-quality materials and components for all areas within high-temperature technologies: Heating elements, insulation, heat shields, susceptors, muffles, as well as charging systems and sinter plates.

The benefits for you
Increased performance: Thanks to their exceptional technical characteristics, our products contribute significantly to the optimization of furnace processes for short cycle times, reduced energy consumption, and distortion-free workpieces.

Tested quality: Our products meet high quality standards in accordance with ISO 9001, thus meeting the specifications for OEMs and operators of high-temperature furnaces.

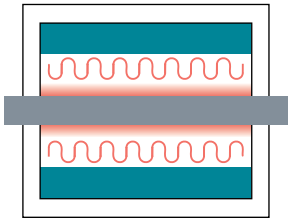
Comprehensive services: We accompany you in finding solutions for your challenges by modern FEM simulation methods. Our long production experience of complex and demanding products facilitate stable and performant operation of your equipment.

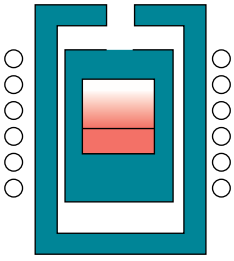
Take advantage of our technical application expertise. We are happy to advise you on how to optimize your processes and develop specific solutions to meet your needs.

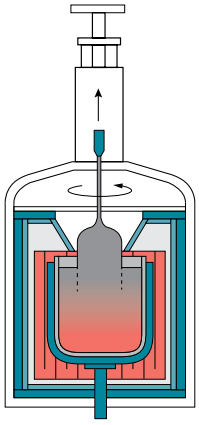
Typical applications

Products of SGL Carbon

Materials used by SGL Carbon







Furnaces in continuous operation

- Carbon-fiber production
- Powder reduction for carbide production
- Sinter furnaces
- Hard solder furnaces
- Heat treatment with oil quenching

- Heaters
- Muffles
- Lining
- Insulation including mounts (cylinders and plates)

- SIGRABOND carbon fiber-reinforced carbon
- SIGRATHERM® rigid and soft felts
- SIGRAFLEX® expanded flexible graphite foils
- SIGRAFINE® isostatically-pressed and extruded graphite

Furnaces in batch operation

- Heat treatment (tempering, gas carburization, annealing)
- Soldering
- High-pressure sinter furnaces
- CVD/PVD furnaces
- Precision casting furnaces
- Hot isostatic pressing

- Charging systems
- Sinter plates
- Heaters
- Muffles
- Lining
- Insulation including mounts (cylinders and plates)
- Heat shields

- SIGRABOND carbon fiber-reinforced carbon
- SIGRASIC® carbon fiber-reinforced silicon carbide
- SIGRATHERM® rigid and soft felts
- SIGRAFLEX® expanded flexible graphite foils
- SIGRAFINE® isostatically-pressed and extruded graphite

Semiconductor furnaces

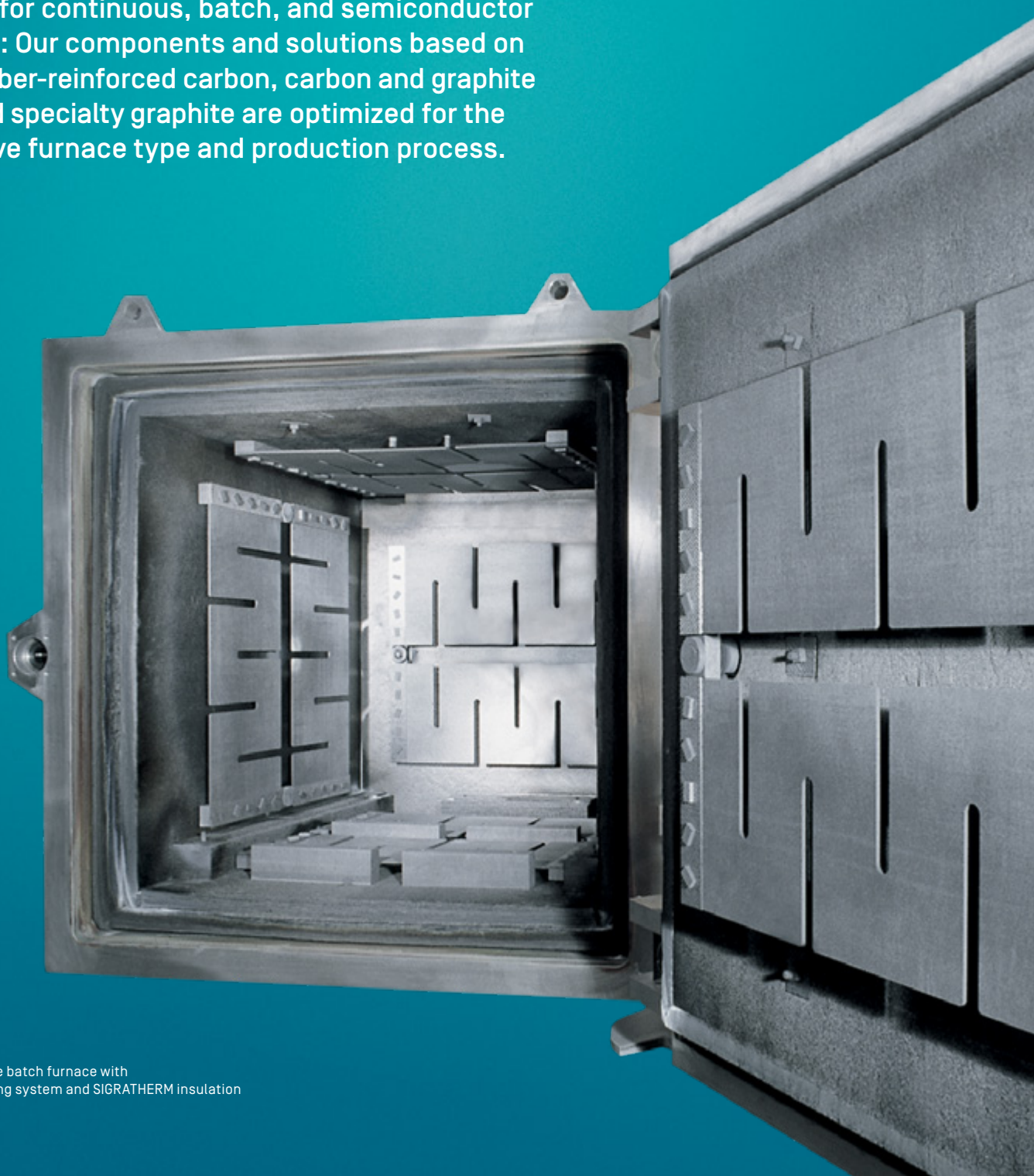
- SiC crystal growing furnaces
- CZ furnaces for silicon and sapphire
- Furnaces for manufacturing optical glass fibers

- Heat shields
- Heaters
- Insulation including mounts (cylinders and plates)
- Crucibles

- SIGRABOND carbon fiber-reinforced carbon
- SIGRASIC® carbon fiber-reinforced silicon carbide
- SIGRATHERM® rigid and soft felts
- SIGRAFLEX® expanded flexible graphite foils
  SIGRAFINE® isostatically-pressed and extruded graphite

Products and services for continuous, batch, and semiconductor furnaces

Whether for continuous, batch, and semiconductor furnaces: Our components and solutions based on carbon fiber-reinforced carbon, carbon and graphite felts, and specialty graphite are optimized for the respective furnace type and production process.



High-temperature batch furnace with
SIGRABOND heating system and SIGRATHERM insulation

Inert gas industrial furnaces in continuous operation

Extensive materials expertise
We are the only fully integrated producer of fiber-reinforced high-temperature composites. The combination of an own raw material production and modern state-of-the-art moulding and high-temperature processes facilitate the production of highly performing end products according your needs. Our well equipped high-temperature laboratory provides important information on the behavior of our materials at highest temperatures.

Optimized for various production processes
In the area of continuous high-temperature industrial furnace systems, we offer solutions based on carbon fiber-reinforced carbon (C/C) and specialty graphite with excellent stability. Our product range includes insulation and muffles as well as heating and charging systems.

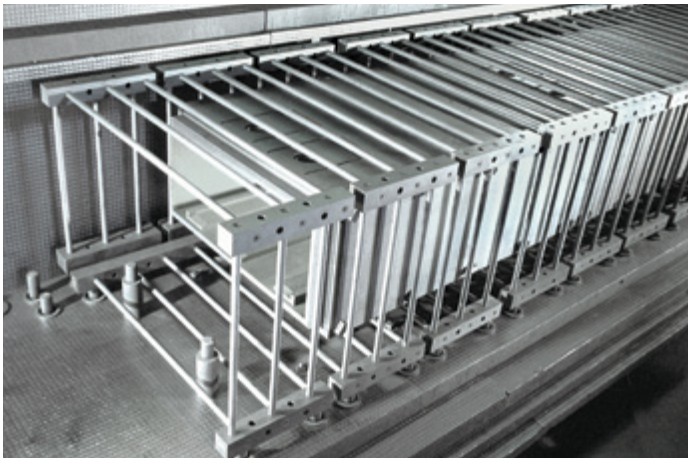
Know more with FEM simulation
With us, you get more than just the materials, you also have the opportunity to predict the behavior of these materials in your high-temperature process.
We utilize FEM simulation methods for:
- Gas flow optimization (CFD)
- Thermomechanical modeling
- Structural-mechanical modeling

In our perfectly equipped high-temperature lab, we are also able to realistically reconstruct the results calculated as well as verify the special high-temperature behavior of our materials.

Optimized solutions for each production process as approx.

- Carbon fiber production
- Powder reduction for carbide production
- Heat treatment including oil quenching
- Hard soldering
- Sintering powder-metallurgy components

↑ FEM-CFD simulation of gas flow through a continuous high-temperature furnace

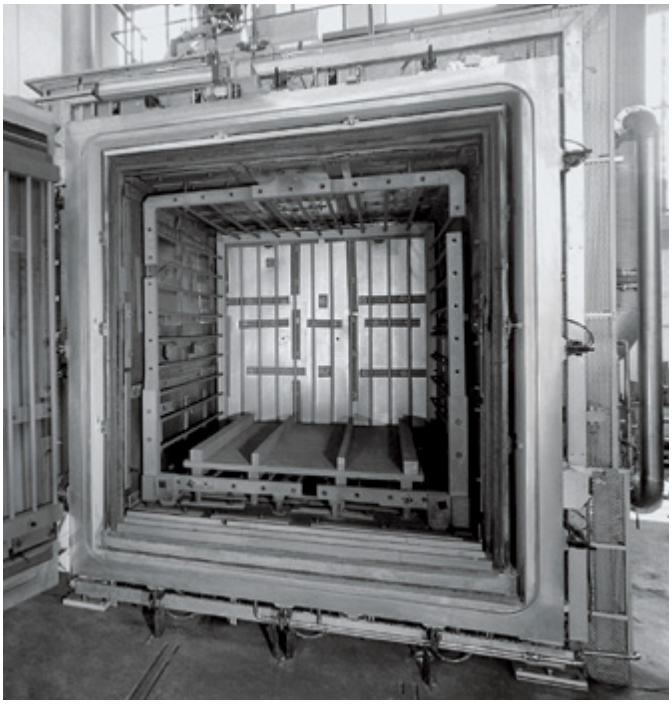


↑ Heating system of a continuous inert gas furnace designed with SIGRAFINE heating tubes and SIGRAFINE HLM muffle

Components for vacuum and inert gas industrial furnaces in batch operation

Your partner for

- **Chamber furnaces**
  Heat treatment
  (tempering, gas carburization, annealing)
  Soldering
  (High pressure) sintering (up to 200 bar)
  CVD-/PVD coating
- **Precision casting furnaces**
- **Hot pressing** (up to 2000 bar / 2200 °C)
  Mechanical pressing
  Hot isostatic pressing



↑ High-temperature furnace with SIGRATHERM rigid felt insulation and long lasting SIGRAFINE graphite heater

Maximize your operating time
High-temperature processes are essential when manufacturing certain materials or for individual production steps. For instance, this includes refining metallic and ceramic workpieces in batch furnaces.

High-temperatures present great challenges for the systems used for such processes. Smooth processes, low energy consumption, and low costs are all important parameters, in addition to the heat resistance. Keeping the overall operating costs as low as possible requires the maximization of operating time.

Graphite, C/C, carbon and graphite felts are predestined for this purpose – after all, they have been specially developed for use at high-temperatures.

Batch furnaces with high service life
Our products based on specialty graphite, C/C, carbon and graphite felts are exceptionally suited for countless applications in vacuum and inert gas furnaces in batch operation due to their long service life. By cleverly selecting the individual components, you can also reduce overall operating costs in many applications. We are happy to advise you during selection.

Components for semiconductor furnaces

Highest purity of our materials
Modern technologies like the fifth generation of mobile communication technology (5G), electromobility, and the expansion of renewable energies are accelerating the demand for particular semiconductor elements.

The fundamental material from which these components are made remains silicon of the highest purity. Single crystal production by means of the Czochralski process is the most widespread production method and is accomplished via high-temperature furnaces in which such purity in the components used has the highest priority.

Our materials are ideal here because we are able to almost completely remove any metallic impurities. Their high homogeneity is also an excellent design basis for finished components, as this allows for targeted and streamlined maintenance in the furnace.

Also optimal for the next industrial level
However, many high-performance components are no longer created based on silicon. Semiconductors like sapphire (aluminum oxide), GaAs, GaN, and silicon carbide in particular are the next industrial step. Even if, for example, the physical vapor transport requires a somewhat different furnace design with silicon carbide, our materials remain the best choice for operating these systems.

Effective systems for solar cell production
Solar cells represent another semiconductor element that is manufactured in great quantities. Our specialty graphites and high-temperature fiber composites will impress you with their longevity in single-crystal growing systems or solidification furnaces, such as those used to produce multicrystalline solar cells.

They help you to operate your systems effectively. Even in downstream process steps, such as coating wafers, specialty graphite and carbon fiber-reinforced carbon are well suited for carrier systems.

↑ SIGRAFINE heater for CZ crystal growth applications guarantee highest purity

Consistent quality via stable processes
Because of their high purity and market-adapted quality, our materials are also used in furnaces that produce optical glass fibers. We guarantee consistent product quality in your demanding furnace systems via stable manufacturing processes. Homogeneous characteristics in the high-temperature heating system create the planned temperature profile within. Good insulation prevents heat drift.

SIGRATHERM® soft felts

Our carbon and graphite soft felts will convince you with their excellent insulation properties, flexible application options, homogeneity, and efficiency.

SIGRATHERM GFA soft felt

Best insulation performance up to 3000 °C at the maximum size range

Low thermal conductivity
Our SIGRATHERM soft felt is indispensable when it comes to meeting the maximum requirements for insulation properties. Our carbon and soft graphite felts feature very low thermal conductivity thanks to our special manufacturing processes – even at temperatures of up to 3000 °C.

Perfect choice for your furnaces
Our soft felt portfolio includes SIGRATHERM KFA carbonized soft felts and SIGRATHERM GFA graphitized soft felts. They are ideal for insulating resistance-heated and induction-heated vacuum furnaces and furnaces with an inert gas atmosphere. Graphitizing soft felts reduces their specific surface area, which reduces pumping times in vacuum furnaces and shortens processing times. The insulation layer has low mass thanks to the low material density.

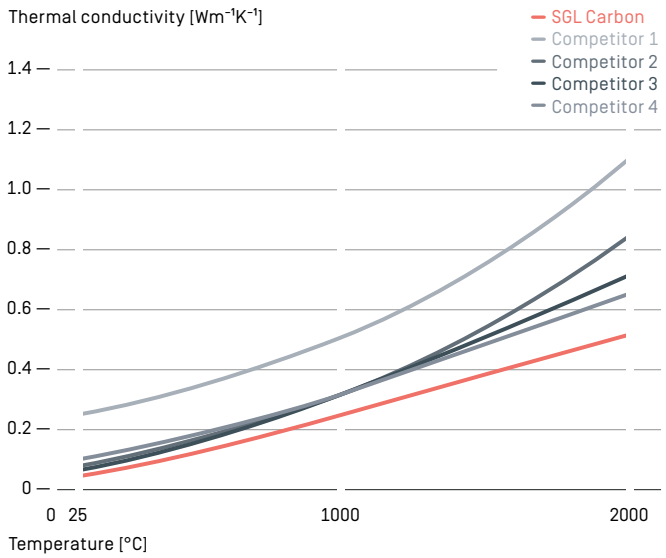
Optimal material utilization, best possible insulation design
We provide SIGRATHERM soft felts with standard widths of 1200 and 1350 mm on rolls of 25 to 30 m. The material utilization when cutting is thus optimal. A thickness ranging from 1.5 to 15 mm ensures the best possible insulation design for various systems. Due to the maximum thickness of 15 mm, large insulation packages can be manufactured on site very efficiently.

Ready to use customized felt insulations
Furthermore, we produce soft felts in custom cuts/formats according to your specific requirements. These plug-in solutions reduce time for maintenance of your high-temperature furnaces and guarantee high availability of your equipment.

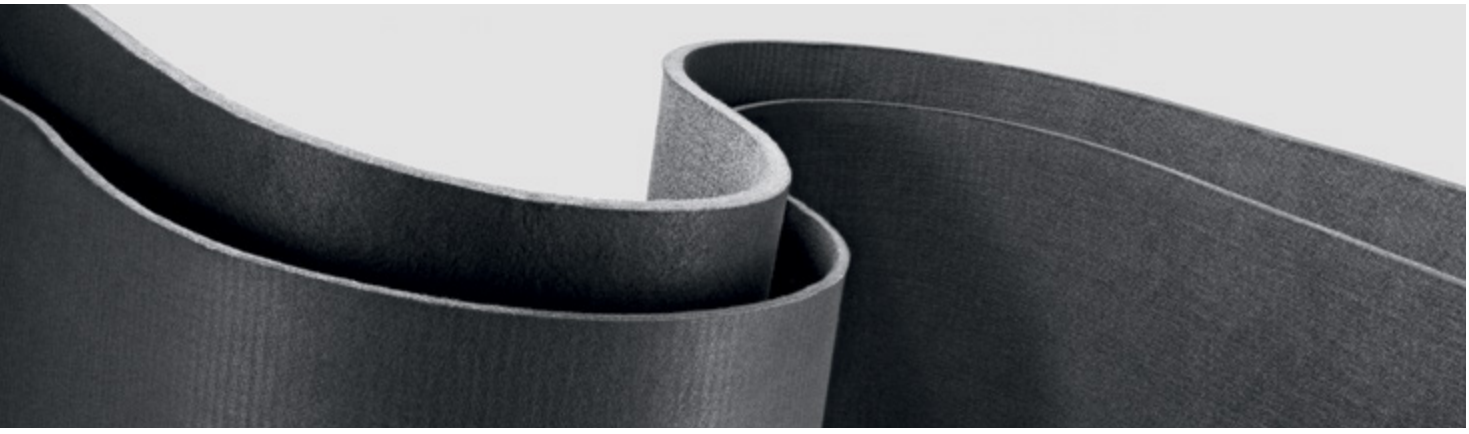
↑ Wrapped and sewed SIGRATHERM soft felt cylinder for crystal growth application

Low thermal conductivity achieves best insulation performance

Comparison of thermal conductivity of several soft felts measured via laser flash method in SGL Carbon's high-temperature laboratory



Perfect for insulating induction-heated furnace chambers



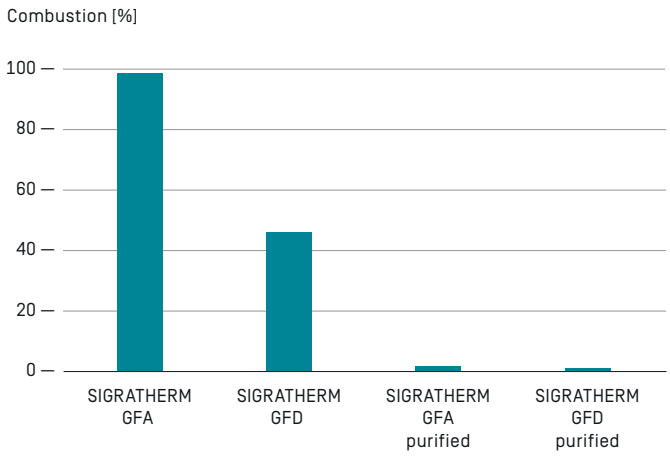
↑ SIGRATHERM GFA soft felt cylinder features low thermal conductivity and homogenous density distribution

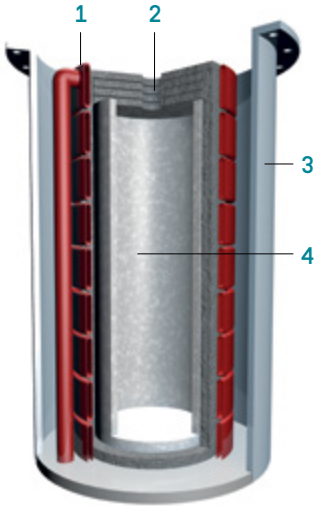
Higher electrical resistance
Our SIGRATHERM graphite soft felts have a much higher resistivity compared to graphite due to the low thickness. This makes SIGRATHERM GFA perfect for insulating induction-heated furnace chambers. There is no coupling in the frequency ranges necessary for heating.

Broader range of application
SIGRATHERM soft felts can be made from various fiber raw materials. These influence the oxidation resistance of the felt. Higher oxidation resistance allows for a broader range of application. The felts can thus be used as insulation in aggressive environments, for example, such as in furnaces that produce glass fibers.

Purified our soft felts shows even higher oxidation resistance

Comparison of weight loss in air at temperature by oxidation of several soft felts (up to 600 °C)





1 Induction coils
2 SIGRATHERM soft felt
3 Steel jacket
4 Graphite susceptor

↑ Illustration of an induction furnace with SIGRATHERM soft felt insulation

High purity and consistent quality

Every atom in its place
Particularly technically demanding industries such as the semiconductor industry rely on materials that are of a consistently high quality. The smallest differences in heat conduction influence the sensitive high-temperature processes and greatly affect the quality of the final material.

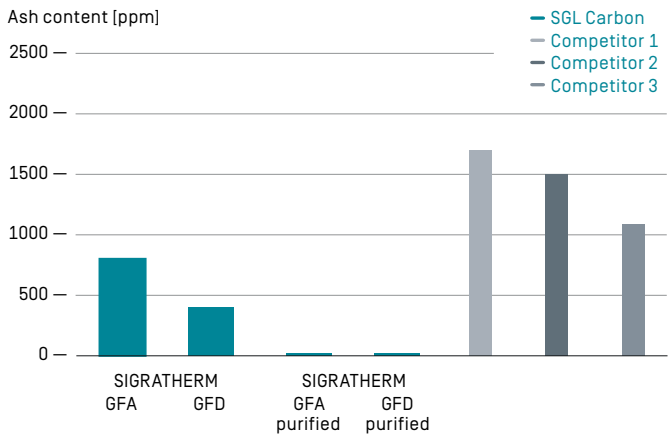
We therefore precisely verify the properties of our soft felt. You can thus be certain that each atom will be in the correct location in the single crystal in your furnace.

No hot spots
Furthermore, we have learned from experience with many international projects that homogeneous thickness distribution is a must when equipping systems identically. Sometimes in high-temperature applications insulation can be 300 mm or more. In these cases you especially benefit from our smooth surfaces and low thickness variation. With our felts, there is no unwanted outflow of energy due to disruptions or deviations in thermal conductivity.

↑ Setup of a CZ crystal growth application with SIGRABOND Filwound susceptor, SIGRAFINE heater and SIGRATHERM GFA soft felt insulation

SIGRATHERM GFA soft felt for use in application with highest purity requirements

Comparison of purity of several soft felts via ash level analysis



Metal and metalloid atoms are removed
The final quality of the crystal is determined by more than simply controlling thermal energies. Foreign atoms, in particular dopants in crystals, lead to malfunctions in the final components.

In order to avoid that, we provide all of our soft felt qualities in a gas-cleaned form. This enables us to remove metal and metalloid atoms from our felts and provide you with material of the highest purity that has no effect on your crystal pulling or growth process. The exceptionally low thermal conductivity is maintained, of course.

SIGRATHERM® rigid felts

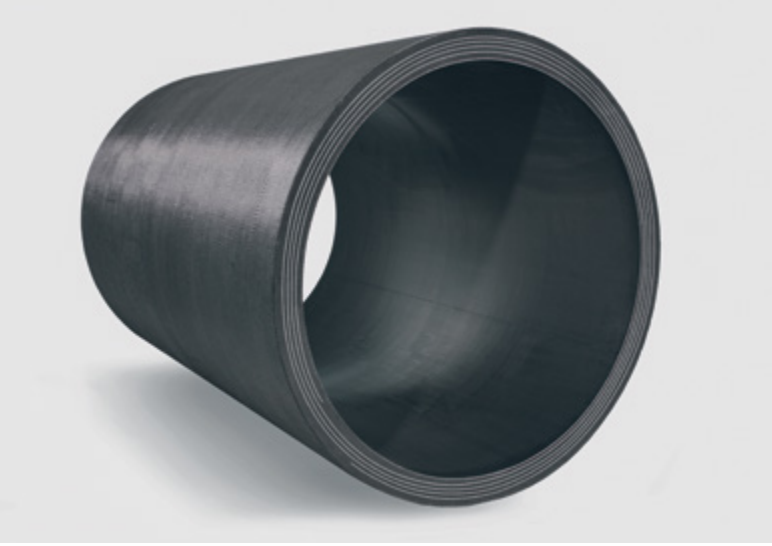
We offer you graphite rigid felts made of short and long fibers. Short fiber SIGRATHERM MFA felt is the first choice for delicate structures. Long fiber SIGRATHERM RFA felt has a higher bending stiffness and is thus best suited for producing large cylinders.

SIGRATHERM MFA multi segment rigid felt insulation

Rigid felts for all needs

Excellent and dimensionally stable insulation
Thanks to their high-temperature resistance, our rigid felts can be used under inert gas or vacuum conditions from 10^{-3} to 10^{-5} mbar at temperatures of up to 2000 °C – or even greater, after detailled evaluation of the process conditions. Even thin, rigid felt layers achieve good and dimensionally stable insulation due to their low thermal conductivity.

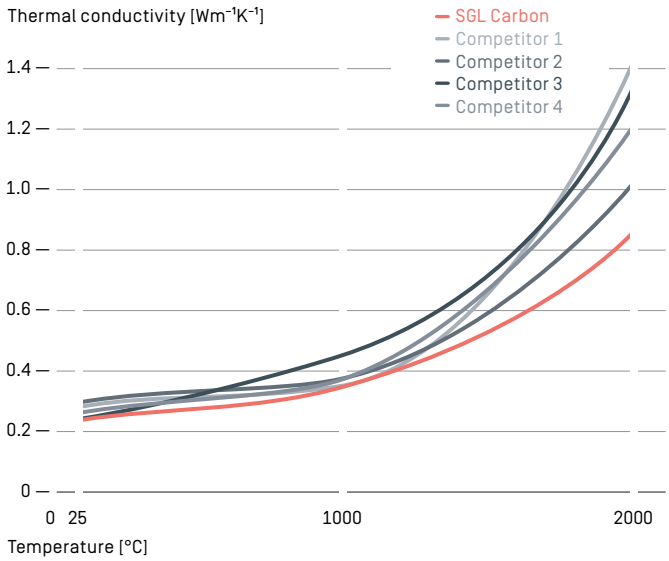
Extensive expertise in production
Our precise workmanship creates plugin solutions that you, as the customer, do not need to adapt yourself. Their high dimensional stability makes self-supporting designs possible and ensures consistent, uniform insulation properties. Labyrinth or tongue-and-groove joints make it easy to connect SIGRATHERM MFA panels with one another, thus allowing large-format structures.



↑ Sandwich cylinder made from SIGRATHERM RFA long fiber insulation

Our rigid felts show very low thermal conductivity

Comparison of thermal conductivity of several rigid felts measured via laser flash method in the SGL Carbon high-temperature laboratory

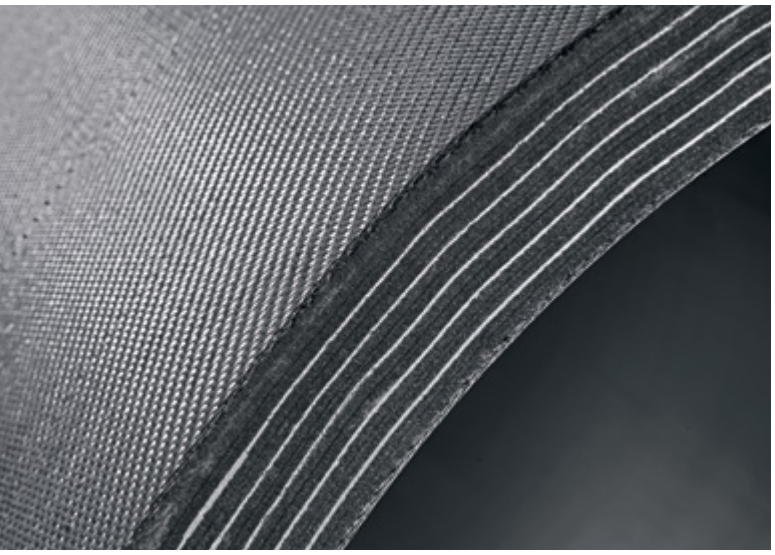


Our product expertise can be seen in single piece cylinders in particular: We are able to manufacture these in diameters of up to 1.5 m and lengths of 4 m. Despite the standard market sizes, we can also manufacture 3D components of rigid felt pads (1524 x 1219 x 440 mm).

Optimize your production
The rigid felt insulation has low mass and low heat capacity thanks to its low material density. SIGRATHERM products coated with SIGRAFLEX foil combine the excellent insulation properties of the rigid felt with the reflective properties for optimal composite thermal insulation, the best possible temperature distribution, and gas tightness.
With SIGRATHERM, you will accelerate processes, increase productivity, and reduce maintenance times.

Protection against damage
As reliable surface protection against mechanical damage, SIGRATHERM can be coated with a mesh made of carbon fiber-reinforced carbon (C/C). It protects the insulation from mechanical and corrosive damage and makes it easier to handle the components.

Smart insulation solutions for high-pressure sinter furnaces



↑ Our special layup in SIGRATHERM HIP insulation cylinders prevents unwanted infiltration

↑ Monolythic SIGRATHERM MFA rigid felt cylinder

Graphite insulation combined with gas barriers
Insulating cylinders and discs for industrial furnaces that produce high-density powder metallurgical components must have special properties. Thermal debinding followed by high-pressure sintering up to 200 bar also requires the perfect combination of various graphite insulations and gas barriers. Stable C/C-reinforced surfaces here ensure dimensional accuracy, good handling properties, and reliable protection against mechanical damage.

Consistent insulation properties
Flawless insulation structures combined with gas-tight barriers made of SIGRAFLEX graphite foil ensure a homogeneous insulation and avoids unwanted convection.

The sandwich structure of SIGRATHERM graphite felts and SIGRAFLEX graphite foils reliably prevents the infiltration of insulation layers due to product outgassing. The insulation properties remain intact and do not deteriorate. This material combination also guarantees you a high availability due to the long service life and energy-efficient operation.

Purest rigid felt for semiconductor applications and manufacturing optical glass fibers

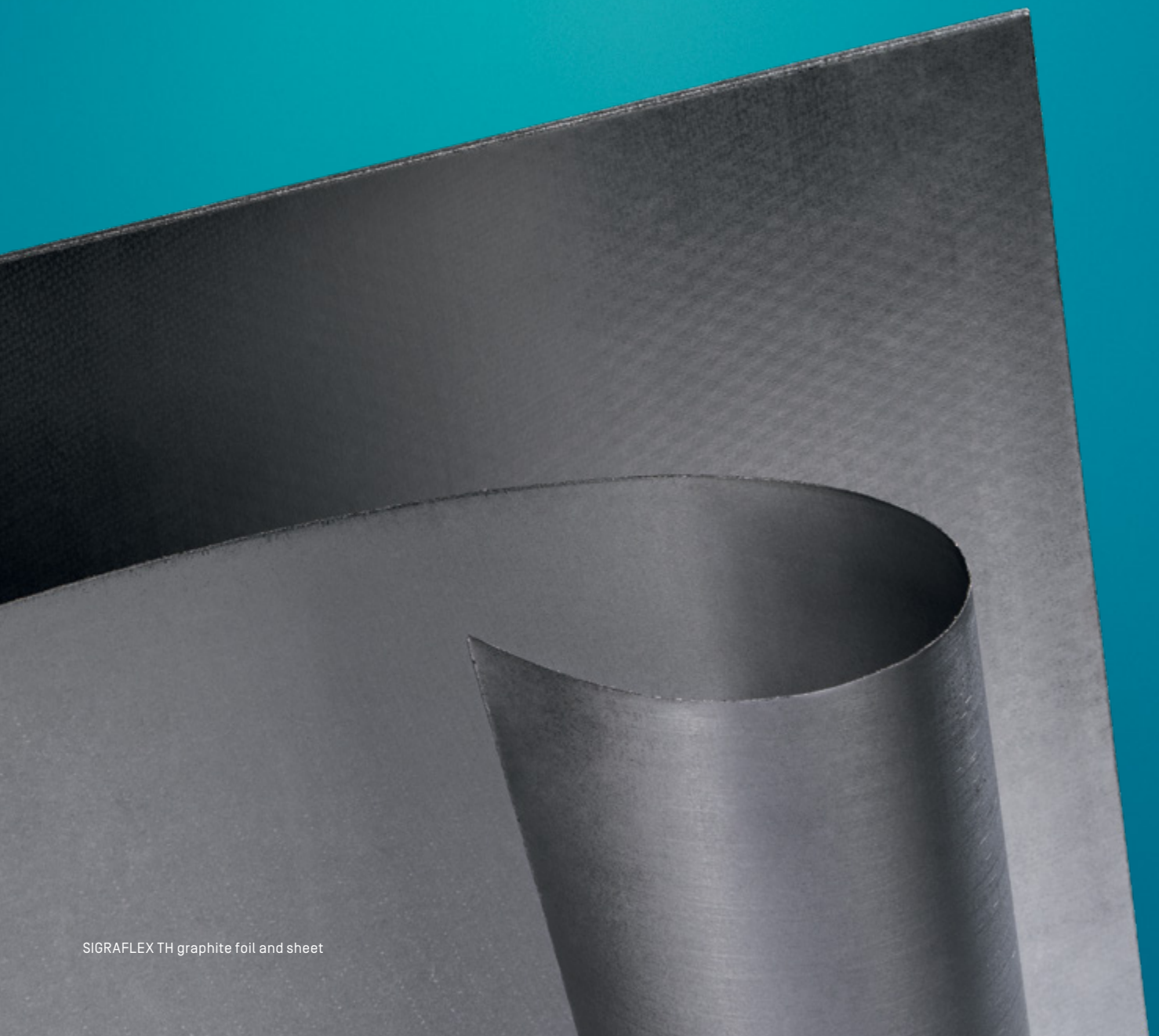
Design tailored to the furnace environment
Rigid felt is dimensionally stable. It can be used to manufacture complicated components and geometries. Its dimensional stability is also an excellent starting point for producing plug in solutions for industrial furnaces, which keep maintenance and operation very simple. The furnaces are operated using inert gas, but the use of glass and the vapor from the molten semiconductor creates a very corrosive environment. At high-temperatures, this gas is exceptionally reactive and causes strong corrosion inside furnaces. In order to counteract this, we create designs that are based on your furnace environment and protect the insulation optimally. This means your systems are more productive.

Optimal use of space
We work with you to develop insulation solutions that allow you to better utilize your furnace chamber, thus increasing system capacity. An example of this is the upgrade of a Czochralski crystal pulling system from 24 inches to 28 inches in size. By cleverly choosing materials from our portfolio as well as our know-how concerning the correct combination, we can minimize the wall thickness of insulation or integrate system components such as heat shields into the insulation.

↑ SIGRATHERM MFA insulation with carbon coating ready to use as plug in part in furnaces for optical fiber production furnaces

SIGRAFLEX® TH graphite foils and sheets

SIGRAFLEX graphite foils and sheets are predestined for use in high-temperature technology due to their unique properties. These foils and sheets increase the efficiency of high-temperature processes and also protect additional insulation components from outgassing. The graphite foils and sheets can also be worked into heat shields and foil blocks.



SIGRAFLEX TH graphite foil and sheet

Ultrapure, flexible, and impermeable

The manufacturing process
We manufacture our SIGRAFLEX foils and sheets from natural graphite. This is first converted into a graphite intercalation compound. The subsequent thermal treatment results in expanded, voluminous graphite flakes, which can be rolled into flexible foils or pressed into sheets and molds without having to add binder.

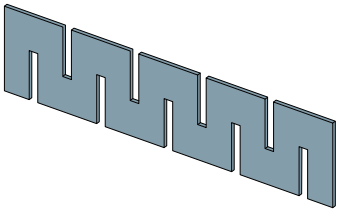
High gas velocities while cooling
Expansion of the material increases the surface and by this directly improve the properties. Additionally we can achieve the required features by customized production.

SIGRAFLEX products are perfectly suitable to be used as heat shields, heating elements, insulators and coverage for rigid felt components.

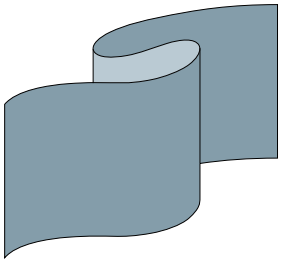
Due to the smooth surface the cooling with high gas velocities is possible without damaging the insulation.

SIGRAFLEX foils and sheets also boast a number of advantages:

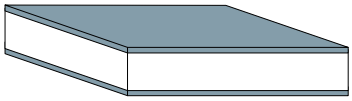
- Soft and flexible
- Easy to work via cutting and pressing
- Excellent thermal conduction and electrically conductive
- No static charging
- High degree of purity
- Aging resistant
- No wetting due to glass, ceramic, and metal melts



↑ Heating element made of graphite sheets

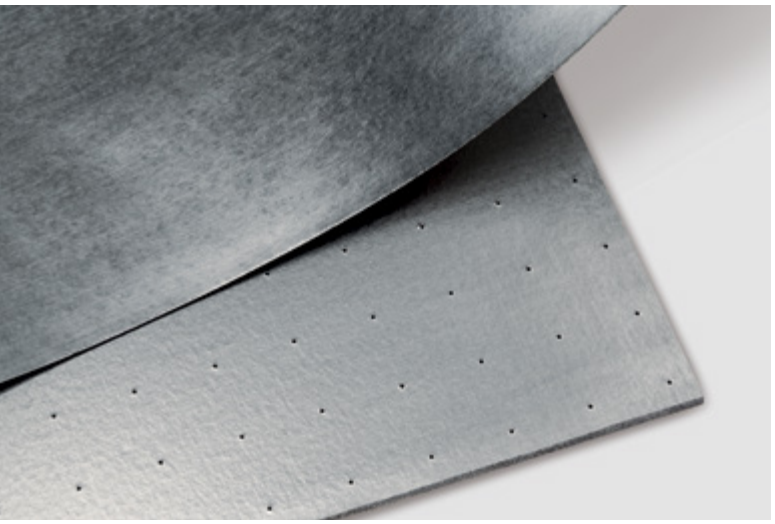


↑ Flexible lining material

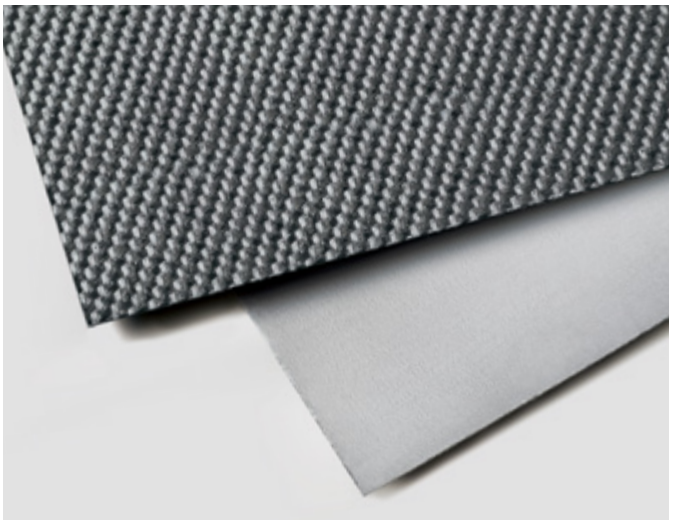


↑ Graphite foil as surface protection

Maximum performance for high-temperature applications



↑ SIGRAFLEX TH foil and perforated sheets made from expanded natural graphite



↑ Composites made from graphite foil and C/C used as heat shield

Higher performance processes and systems
SIGRAFLEX products made from expanded natural graphite increase the performance of systems and processes in the high-temperature range, reduce energy consumption, and ensure maximum reliability in production.

SIGRAFLEX products are used by many well-known customers in the following applications, for instance:

- Heating elements
- Lining for melting crucibles
- Casting molds
- External cladding for hot-press molds
- Protective strips for welding, soldering and sintering work
- Carrier material for separating thin metal foils from the gaseous phase
- Protective material against laser beams
- Surface coating for insulation felts
- Gas diffusion barrier layer in sandwich insulation

Heat shield to protect insulation
SIGRAFLEX foils and sheets can also be worked into heat shields and foil blocks. The heat shield (composite of C/C and foil) proves itself via its higher mechanical stability, thus protecting the insulation. They also reduce the moisture absorption of the insulation and increase reflection.

Carbonized foil blocks
We also work SIGRAFLEX foils into carbonized foil blocks. These can be used for a wide range of applications in high-temperature furnace design, such as heat shields or as an alternative to charging plates.

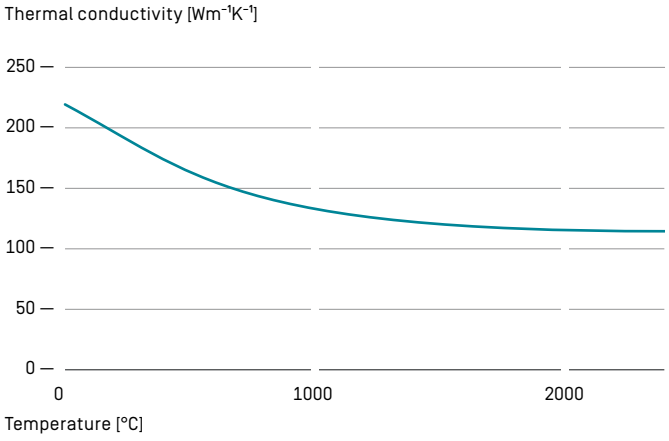
Material data of SIGRAFLEX® TH with a bulk density of 1.0 g / cm³

Typical properties		Units	Values
Sublimation temperature		°C	> 3000
Temperature resistance	in air inert gas / vacuum	°C	approx. 400 approx. 3000
Specific electrical resistivity (20 °C)	parallel to surface perpendicular to surface	µΩm	11 700
Thermal conductivity (20 °C)	parallel to surface perpendicular to surface	$Wm^{-1}K^{-1}$	220 5
Specific heat capacity (20 °C)		$kJkg^{-1}K^{-1}$	0.7
Thermal expansion coefficient (20 – 1000 °C)	parallel to surface perpendicular to surface	$10^{-6}K^{-1}$	approx. 1 approx. 50
Shore hardness (D)			30
Elongation at break		%	≥ 1
Tensile strength		N/mm²	≥ 4
Permeability coefficient for air	perpendicular to surface	cm²/s	2×10^{-5}
Coefficient of emission (1500 °C)			0.65
Ash content		%	approx. 0.1

Other values or dimensions on request

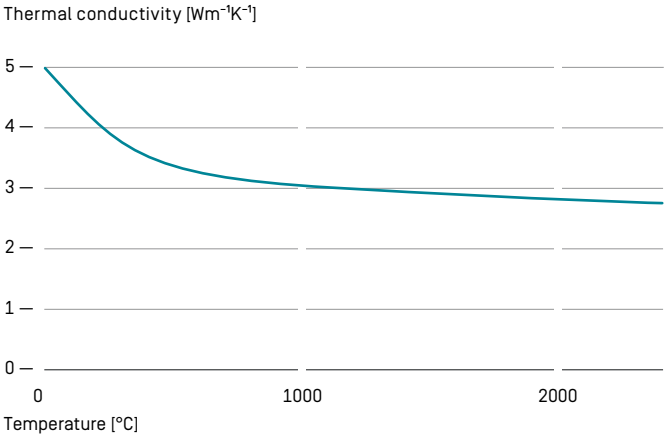
Thermal conductivity decreases with temperature increase

Thermal conductivity of SIGRAFLEX with density of 1.0 g/cm³ in plane to surface as function of temperature



Also perpendicular to the plane thermal conductivity decreases with increasing temperature

Thermal conductivity of SIGRAFLEX with density of 1.0 g/cm³ perpendicular to surface as function of temperature



SIGRABOND carbon fiber-reinforced carbon

Highest stiffness and resistance for temperatures of over 2000 °C: SIGRABOND C/C allows for thin designs and maintains the dimensions of your product. Our design team uses state-of-the-art methods including FEM simulation to develop the most efficient solution for your high-temperature application.

SIGRABOND Performance charging system

Component development, production, and design

Fully-integrated production
As the only manufacturer of fiber composites, we cover all stages of production, from the fiber to the finished components. We offer you outstanding system solutions because of our unique market expertise. We develop, design, and manufacture high-performance components made of carbon fiber-reinforced carbon (C/C) that is tailored to your specific requirements.

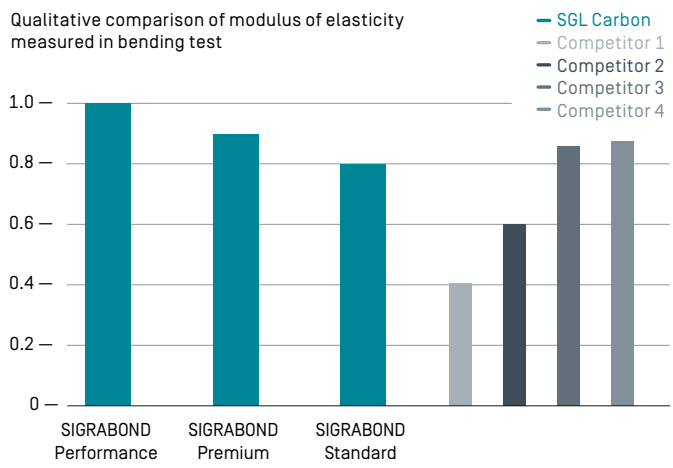
The highest bending stiffness on the market
SIGRABOND Performance is the C/C material with the highest bending stiffness on the market. You can thus use your furnace capacities to the fullest extent. Your employees also benefit: The much lower weight – compared to solutions using metal materials – results in a much improved ergonomics.

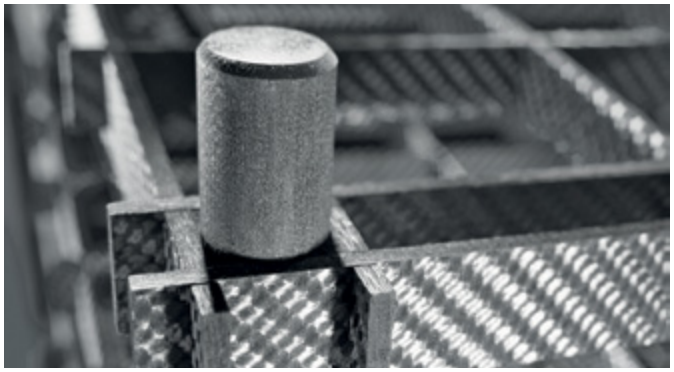
↑ SIGRABOND heater produced via filament winding

C/C plates for components and system solutions
Our portfolio also includes C/C plates based on carbon fiber meshes or unidirectional carbon fiber cores. We produce these in thicknesses of 0.8 to 30 mm, in the 2450 mm x 1220 mm format. Large-format plates are best suited for producing cost-optimized components and system solutions. We also manufacture profiles and mounting elements for equipping furnace chambers.

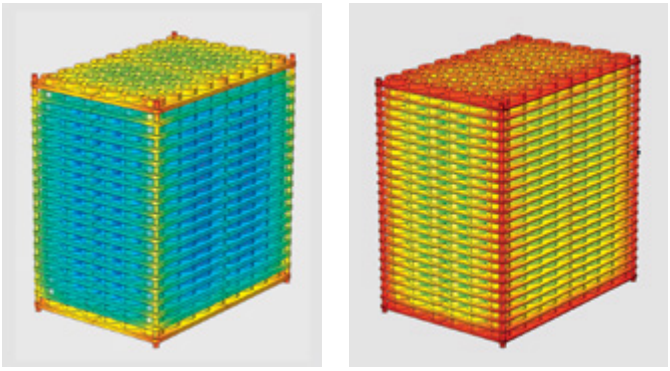
Round components with targeted properties
In addition to plate structures, we also produce round components with targeted properties using winding technology. Winding processes also enable us to efficiently achieve high wall thicknesses. Fabric-based tubes are produced via lamination. These are special because of their excellent workability, even for complicated structures, as is often required for heating systems.

SIGRABOND Performance with highest stiffness





↑ Corner connection as C/C and graphite hybrid design



↑ SIGRABOND Sinter plates facilitate optimized loading compared to graphite

SIGRABOND C/C charging systems

From stability even after many cylcles
Our SIGRABOND charging systems do not exhibit any signs of material fatigue or warping – even after hundreds of furnace cycles. The tool holders can be mechanically loaded and unloaded for years and years without problems. Time-consuming and expensive manual adjustment work is eliminated, scrap expenses are reduced, and productivity and cost-effectiveness are increased.

Additional benefits of SIGRABOND C/C charging systems:
- Shorter process times and lower energy consumption
- Increases the system's load capacity
- Eliminates the need to adjust the system
- Long service life
- Easy handling thanks to low weight
- Enables automated loading

More capacity with SIGRABOND Performance
With SIGRABOND Performance, we have developed a C/C material that has been optimized for the requirements of charging systems. High flexural modules and flexural strength enable more streamlined system designs and increase capacity.

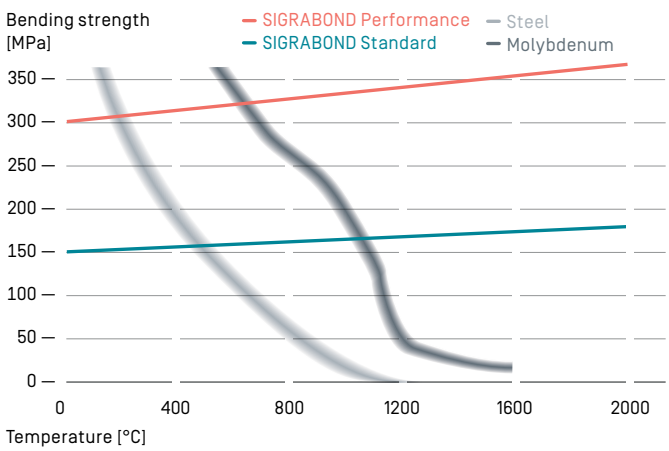
SIGRABOND Sinter

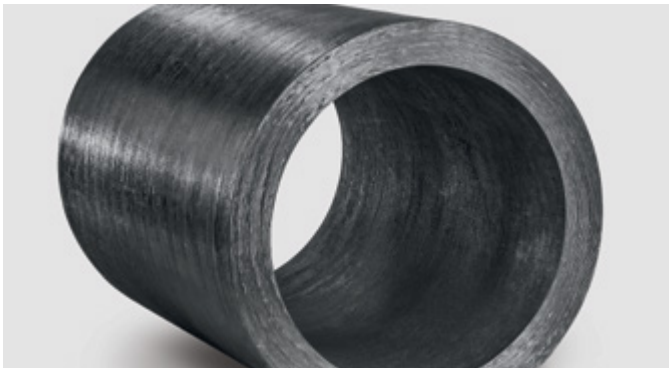
The cost-efficient C/C material
SIGRABOND Sinter was developed to improve batch volumes in existing sintering systems. With this cost-optimized C/C brand, we offer our customers the best price to performance ratio for sintering charge carriers.

Increasing your production capacity
You can utilize your sintering systems to the fullest extent and increase production capacity in existing systems by more than 25 %. The lower thermal mass combined with the larger loading surface ensures a homogeneous temperature distribution and guarantees consistent product quality.

Bending strength of C/C increase with temperature

Typical hot bending strength of some high-temperature materials





↑ SIGRABOND Filwound hot pressing die for production of technical ceramics and hard metals

↑ SIGRABOND Filwound susceptor for 32 inch CZ crystal growth furnaces

SIGRABOND Filwound

Heavy-duty for use in mechanical high-pressure sintering
C/C hot press dies are indispensable for the efficient operation of high-pressure sinter systems over 2000 °C. Increasing requirements on products also require higher and higher pressing pressures. Graphite is thus exceptionally suited for use as a press die material. Helically-wound structures made of carbon fibers are required for safe operation as they have the necessary bursting resistance.

High quality and reliability
SGL Carbon is a pioneer in the manufacturing of these structures. Because of our decades of production experience, we can guarantee you consistent quality with high reliability.

SIGRABOND C/C heaters and C/C crucibles

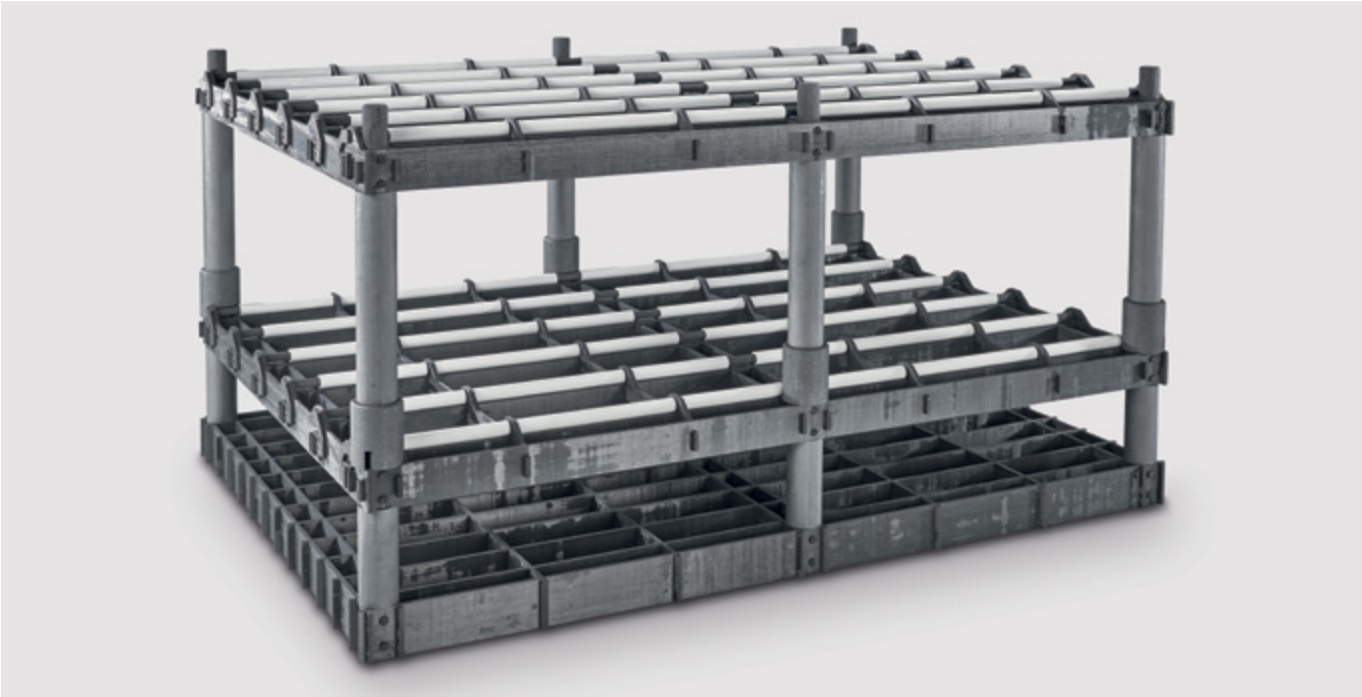
Wide resistance range
Certain circumstances can make the use of graphite heating elements in industrial furnaces complicated. This is precisely why we manufacture heating elements made of carbon fiber-reinforced carbon (C/C). We therefore provide laminated and wound variants, thus covering the wide variety of necessary resistance applications.

Not brittle and electrically conductive
The decisive advantages of using heating elements made of C/C are the non-brittle fracturing behavior as well as the high electrical loading capacity. The material is also absolutely resistance to thermal shock and can easily master the highest heating rates.

Optimized furnace volume use
C/C heaters are normally thin and help to fully utilize the furnace volume. Combined with our best insulating rigid and soft foam solutions, existing systems can be modified to increase output.

Support for producing the purest semiconductors
Converting crystal growth systems is particularly effective. We manufacture not only thin insulation and space-optimized heating systems, we also produce melting crucibles made of carbon fiber-reinforced carbon. Greater quantities of molten mass can be handled despite the thinner wall thicknesses. This is how you increase the performance of your systems. For your applications in semiconductor technology, the crucible is freed of metallic impurities, just as with rigid and soft insulation systems. This allows us to assist you in the production of the purest semiconductors for the semiconductor components of tomorrow.

Industry 4.0 – automating heat treatment processes with SIGRABOND



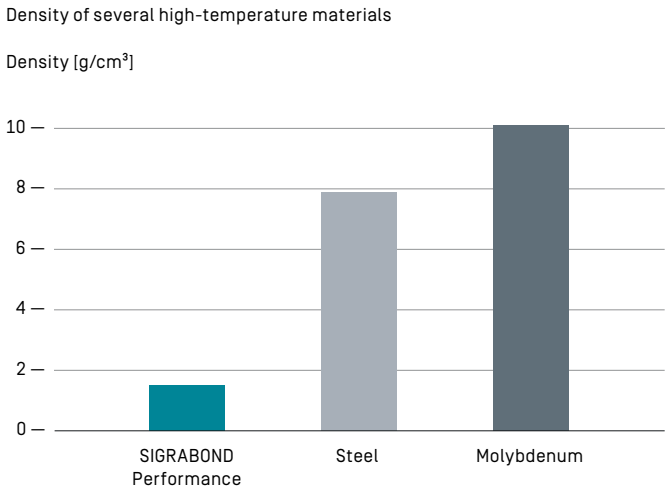
↑ SIGRABOND Performance C/C hybrid charging rack with ceramics for carburization protection

Dimensionally stable, even with extreme temperature deviations
SIGRABOND Performance is exceptionally dimensionally stable compared to steel. Even great temperature changes in quenching processes are no problem due to the high thermal shock resistance of our carbon fiber-reinforced carbon materials.

Because the shape of the charge carrier is retained after many such cycles, robots are able to reliably control the component position during loading and unloading.

Positive side effect: the reduced weight of the charge carrier. This increases the net furnace loading.

SIGRABOND Performance has much lower density than other high-temperature materials

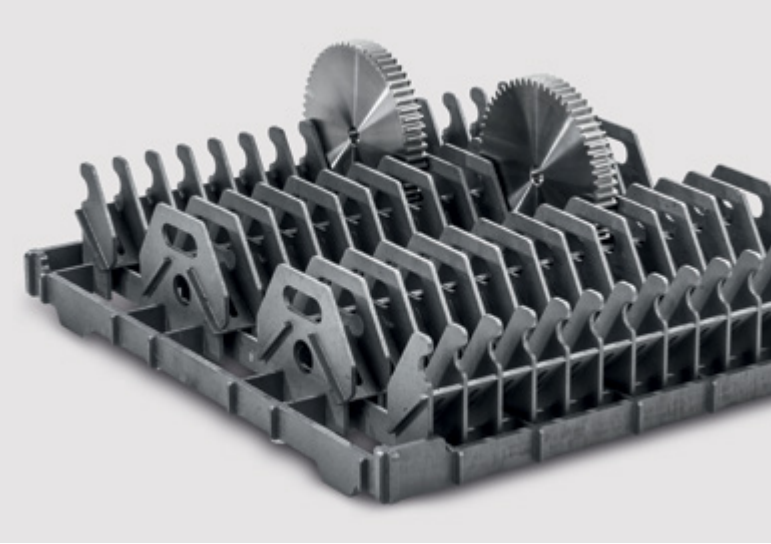


Automation of heat treatment processes with SIGRASIC®

SIGRASIC – first choice for automated oil hardening processes
Standard C/C materials reach their limits in hardening processes using oil quenching and the subsequent rinsing process. The reason for this is the open porosity, in which the oil and rinse media collect. During the subsequent heating phase, these condense and contaminate the furnace atmosphere.

SIGRASIC is our solution to this problem, as the material is not porous. In addition, it has a low weight, is stable over the long term, and does not deform.

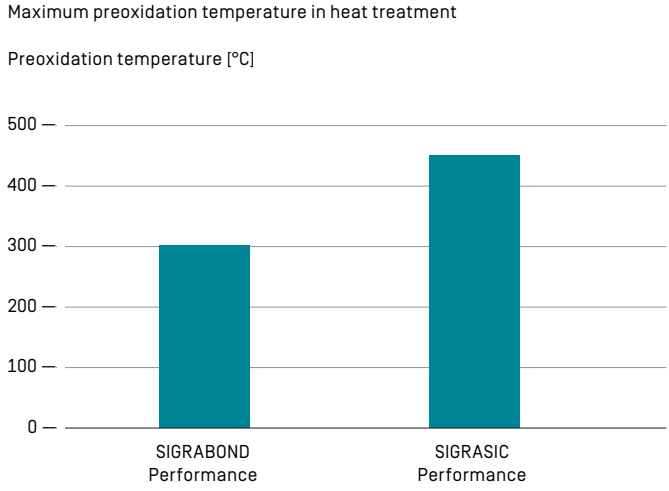
The batch preoxidation process that is commonly used in oil quenching requires an oxidation resistance in the charge carrier for a temperature of up to approx. 500 °C, a requirement that SIGRASIC also meets.



↑ Charging rack made from SIGRASIC Performance for heat treatment including preoxidation and oil quenching

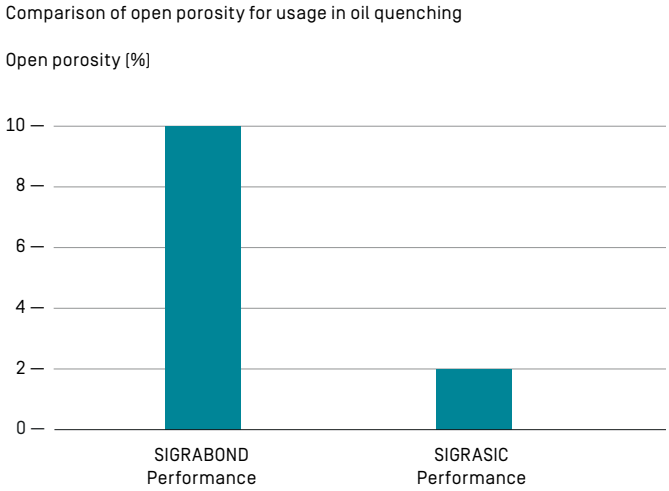
SIGRASIC is compatible with preoxidation

Maximum preoxidation temperature in heat treatment



SIGRASIC Performance features low open porosity

Comparison of open porosity for usage in oil quenching



Successful together

We do not just manufacture products, but also provide intelligent solutions with sustainable benefits for our customers.

Close collaboration and an understanding of specific requirements allow us to develop forward-looking solutions and respond to specific needs.

This has given rise to most of our innovation – such as the SIGRATHERM HIP rigid felt insulation cylinder.

200 bar – possible with us

Expanding the portfolio, a leading manufacturer of high-pressure sinter furnaces developed a high-pressure system, which works with pressure of up to 200 bar.

In order to facilitate this new furnace technology, new insulation solutions had to be developed. The combination of multiple materials of our portfolio achieved a lay-up that maintains the pressure distribution within the furnace. This allows a consistent sintering result of the end product at highest pressures.

We developed a tailor made insulation solution with perfect characteristics for the use in the customer process

SIGRATHERM® HIP

Thanks to our extensive materials expertise and our know-how in the high-temperature range, and because of our faithful cooperation, we were able to specify the characteristics of our products to meet the demanding requirements of advanced sinter systems.

Smart Solutions

Be it materials, components or production processes, we focus our thinking and actions on the customer and keep an eye on the big picture. Our solutions already anticipate the future today.

The following examples show a selection of our unique product range.

Mobility

- Lightweight components and structural parts based on fiber-reinforced composites for automotive and aerospace manufacture
- Graphite anode material for lithium-ion batteries in electric vehicles
- Carbon-ceramic brake disks for sports cars and luxury sedans

Energy

- High-temperature solutions based on specialty graphites and fiber materials for the photovoltaic industry
- Carbon fiber materials for rotor blades
- Gas diffusion layers for fuel cells
- Systems for more efficient heat exchange and heat recovery
- Carbon fibers for pressurized gas containers

Digitization

- Carbon, graphite, and CFC components for polysilicon and monocrystal pulling in the semiconductor industry
- High-precision, coated graphite carriers for the production of semiconductor chips and LEDs

→ State-of-the-art green production with the world's largest isostatic press

SGL Carbon

We are leaders in the development and manufacture of products based on carbon, graphite, carbon fibers, and fiber-reinforced composites. In partnership with our customers, we develop intelligent, trendsetting, and sustainable solutions that deliver a clear benefit.

With our in-depth material, engineering, and application know-how, we make a substantial contribution to the major future topics mobility, energy, and digitization.

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