

Broad Base. Best Solutions.



GRAPHITE MATERIALS AND SYSTEMS

Specialty Graphites for the Glass and Refractory Industries

Specialty Graphite and Process Solutions – made by SGL Group.

- **Advanced material, equipment, and process solutions**
- **Engineered for customers from more than 35 industries**
- **Tailor-made from the most comprehensive product portfolio**
- **In-depth production and material knowledge**
- **Consistent high quality, performance, and service**
- **Attractive total cost of ownership**

Broad Base. Best Solutions.



Advanced solutions enable our customers to get ahead.

SGL Group offers advanced solutions – even for challenging applications. We understand the specific requirements of our customers and combine in-depth production, material, and engineering knowledge with the most comprehensive specialty graphite portfolio. This makes us the partner of choice to leading companies in many different industries.

Exceptional resistance to heat and corrosion, high purity and mechanical strength are just a few of the outstanding properties which our materials offer. Specialty graphite products from SGL Group achieve optimal results where other materials fail. No matter what your specific requirements might be, we will identify the best solution from the most comprehensive range of specialty graphites.

- Fine grain graphite: isostatic, vibration-molded, die-molded, extruded
- Expanded natural graphite
- Carbon fiber-reinforced carbon (C/C)
- Soft and rigid graphite felts
- Silicon carbide-coated graphite materials

Additionally we use other materials like PTFE, silicon carbide, and specialty metals.

With our portfolio and technical know-how spanning more than 35 different industries,

← Manufacturing of conveyor channels from SIGRABOND to carry the gobs of molten glass in the hollow glassware production

we engineer tailor-made solutions in close partnership with our customers.

SGL Group covers the entire value chain of specialty graphite production, including raw material processing, semi-finished product manufacture, precision machining, purification, and coating. When it comes to engineering of equipment and process solutions our service range makes the difference: We offer mechanical and process design, production, assembly, commissioning, and service – all from a one-stop shop. This is how we control and ensure the consistent high quality, reliability, and performance of our products – and enable our customers to become more competitive. Challenge us. We are there for you worldwide.

Specialty graphite solutions for the glass and refractory industries

Innovative specialty graphite solutions offer important advantages when it comes to meeting the challenges of glassmaking and refractory processes. Our optimized machine components and high-performance materials make us many leading companies' partner of choice.



Specialty graphites – made by SGL Group.

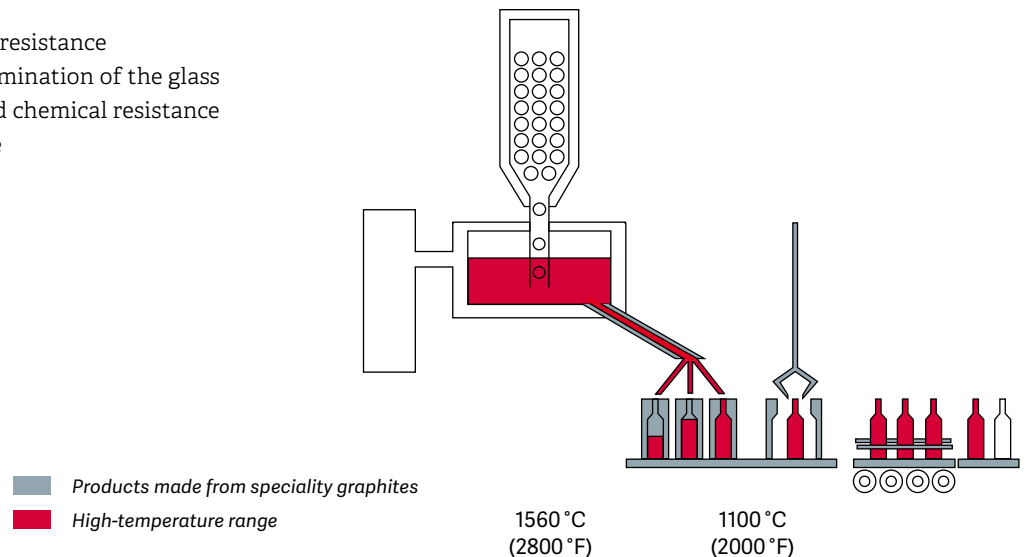
Solutions for the glass and refractory industries.

Products and materials made from graphite are becoming increasingly established in the glass industry. Our portfolio makes it possible to use optimized materials, such as very lightweight components produced from SIGRABOND carbon-fiber-reinforced carbon (C/C), which relieve the mechanical system. In addition, our materials and components produced from SIGRAFINE fine-grain graphites offer the following properties:

- High heat and thermal shock resistance
- Minimized carbon dust contamination of the glass
- High mechanical strength and chemical resistance
- Excellent corrosion resistance
- Low oxidation



SIGRAFINE® is the new brand name for our fine-grain graphites, previously known under the names RINGSBORFF®, SIGRAFORM®, SIGRAMENT® and CRYSTA-SIL®.



Industry

Materials made of carbon and graphite

Products of the SGL Group

Container glass

SIGRAFINE® isostatic and extruded graphites, die-molded carbon
SIGRABOND® carbon fiber-reinforced carbon (C/C)

Conveyor channels
Gob conveyor channels
Blow molds
Grippers
Guide rails
Sliders

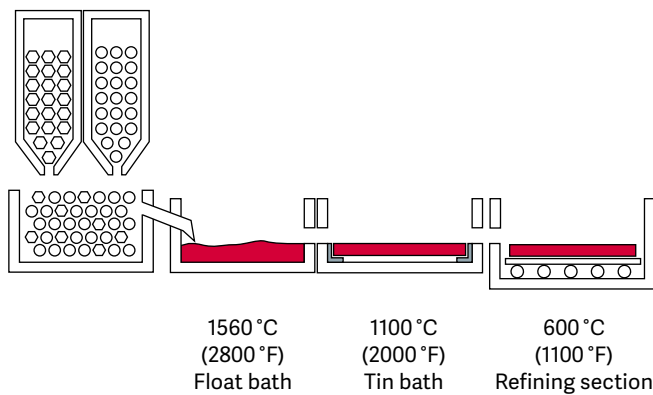
Contact elements
Ejector arms
Distributors
Slide triangles
Setdown plates

For our customers in the glass and refractory industries, everything revolves around the melting and molding processes. With the increasing demands on material purity, surface quality, precision, design, energy and cost efficiency, the requirements for components and systems are becoming ever more challenging. The focus is increasingly on specialty graphites.

+ **Video:** Isostatic graphite, a key product for the high-tech industry.
[YouTube](#) [sglgroup](#)

SGL Group is proud to be able to offer best solutions, even for the most challenging tasks. With our innovative, high-performance materials and products, we support the development of the glass and refractory industries. Our many different materials are appreciated for their outstanding technical properties and ability to meet the most demanding requirements in terms of quality, cost efficiency, and eco-friendliness.

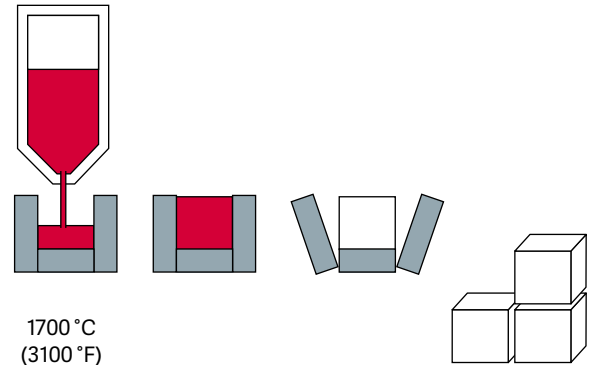
Our specialty graphites and graphite components enhance the performance of systems and processes in numerous applications – from the production of flawless glassware to thermal and acoustic insulation.



Float glass

SIGRAFINE® extruded, vibration-molded, and isostatic graphites
 SIGRATHERM® soft graphite felts

- Barriers
- Side linings
- Supports
- Support barriers
- Thermal insulation material



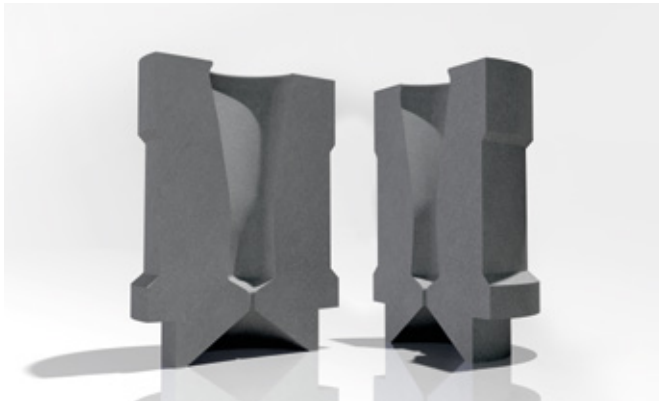
Refractory

SIGRAFINE® extruded and vibration-molded graphites

- Melting troughs
- Electrodes
- Bottom plates
- Linings
- Tapping pipes
- Cooling plate supports



Specialty graphites and components for container glass manufacture



↑ **SIGRAFINE carbon mold**
for producing hollow glassware

No matter whether producing technical glass, laboratory glass, inspection glass or domestic glass, the key requirements after the melting process are dimensional accuracy, optical perfection, purity, consistent quality, and physiological safety. Our carbon fiber-reinforced carbon (C/C) products and isostatically pressed specialty graphites play an important role in achieving the best results in a cost-effective manner.

Graphite is a very versatile material with a wide range of applications, especially in the industrial hollow glass and container glass industries. We provide innovative solutions:

C/C conveyor channel systems move rapidly and flexibly in mold filling and do not require coating with a special finish/paste or spraying with oil thanks to their good antifriction properties. The gob surface remains undamaged.

Carbon molds combine the advantages of wood molds with those of graphite. The porous structure stores water that forms a moisture vapor film as the molten glass is introduced. During the actual glass blowing process, the vapor formed ensures freedom of contact between the graphite and the melt. Even very fine details and low tolerances are no problem.

Graphite contact elements, such as grippers or guides made from isostatically pressed graphite, transport the hot fragile glass products to the dead plates and cooling ovens.

Products made from graphite, carbon and composites

Components	Graphite		Carbon	C/C
	isostatic	extruded		
Conveyor channels	•	•		•
Gob conveyor channels				•
Blow molds			•	•
Grippers	•			
Guide rails	•		•	•
Sliders	•			•
Contact elements	•		•	•
Ejector arms	•			•
Distributors	•			•
Slide triangles	•			•
Setdown plates	•	•		•

Standard dimensions of our main grades for container glass manufacture

Isostatic graphite		Extruded graphite	Carbon	C/C	
SIGRAFINE R7340	SIGRAFINE R7510	SIGRAFINE HLM	SIGRAFINE R7141H	SIGRABOND Standard	SIGRABOND Premium
200 x 410 x 1550 mm	400 x 500 x 610 mm	500 x 500 x 1830 mm	∅ 115 x 200 mm	1220 x 1220 x 0.7 mm	2450 x 1220 x 3.0 mm
400 x 500 x 610 mm	400 x 500 x 1230 mm	500 x 500 x 2750 mm	∅ 115 x 255 mm	1220 x 1220 x 1.1 mm	2450 x 1220 x 5.0 mm
400 x 500 x 1230 mm	∅ 390 x 1230 mm	600 x 600 x 3300 mm	∅ 115 x 305 mm	1220 x 1220 x 1.8 mm	2450 x 1220 x 7.0 mm
∅ 150 x 1230 mm	∅ 450 x 1230 mm	610 x 760 x 2540 mm	∅ 130 x 175 mm	1220 x 1220 x 2.2 mm	
∅ 180 x 1230 mm	∅ 470 x 1230 mm	∅ 75 x 1830 mm	∅ 130 x 255 mm	1220 x 1220 x 4.0 mm	
∅ 200 x 1230 mm	∅ 510 x 1230 mm	∅ 100 x 1830 mm	∅ 130 x 305 mm	1220 x 1220 x 5.0 mm	
∅ 225 x 1230 mm	∅ 580 x 800 mm	∅ 150 x 1830 mm	∅ 145 x 255 mm	1220 x 1220 x 7.0 mm	
∅ 250 x 1230 mm	∅ 625 x 660 mm	∅ 200 x 1830 mm	∅ 160 x 305 mm		
∅ 280 x 1230 mm	∅ 660 x 800 mm	∅ 250 x 1830 mm	∅ 205 x 230 mm		
∅ 320 x 1230 mm	∅ 725 x 730 mm	∅ 300 x 1830 mm	∅ 205 x 305 mm		
∅ 350 x 1230 mm	∅ 775 x 730 mm	∅ 350 x 1830 mm	∅ 245 x 255 mm		
∅ 380 x 1230 mm	∅ 850 x 550 mm	∅ 400 x 1830 mm			
∅ 420 x 1230 mm	∅ 920 x 420 mm	∅ 450 x 1830 mm			
	∅ 1020 x 450 mm	∅ 500 x 1830 mm			
	∅ 915/500 x 630 mm	∅ 600 x 2080 mm			
	∅ 1190/780 x 750 mm	∅ 710 x 1830 mm			
		∅ 760 x 1830 mm			
		∅ 915 x 1830 mm			

Other grades and dimensions on request. Please contact us.

You will find the dimensions in inches in the data sheet enclosed with the brochure.

Our specialty graphites are impact-resistant, thermally stable, and resistant to thermal shock and corrosion. In addition to favorable porosity and good antifriction properties, they also offer application-tailored thermal conductivity and low wettability and adhesion in contact with molten materials. They are therefore outstandingly suitable for machine components in the container glass industry and stop contamination as well as surface and mechanical damage. Thanks to their high flexural strength, even at elevated temperatures, our isostatically pressed graphites and C/C, in particular, reliably prevent cool spots on lying surfaces and glass distortion.

We provide support for our customers based on our comprehensive expertise with materials and our long-standing experience with a wide range of applications. In material selection, numerous criteria need to be taken into account, such as accurate replication of detail, service life, combustion behavior or component size. Our SIGRAFINE and SIGRABOND materials ensure optimum results and eliminate the need for internal cool coatings and special surface treatments.



Optimization partner for contact elements

In close collaboration with OEMs and end users in the container glass industry, we have developed a unique new C/C conveyor channel system offering the following improved properties:

- Lower oxidation
- Higher loading speed
- Excellent anti-friction properties thanks to low hardness, eliminating the need for coating or oil spray
- No surface damage or contamination of glass

This is just one example of an application-specific optimized solution from the SGL Group.



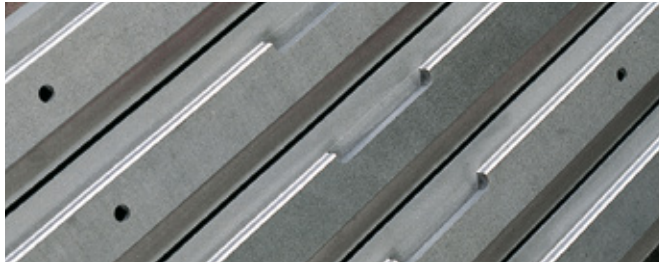
Specialty graphites and components for float glass manufacture

Standard dimensions of our main grades for float glass manufacture

Extruded graphite		Isostatic graphite	Soft graphite felt	
SIGRAFINE HLM		SIGRAFINE R7550	SIGRATHERM GFA5	SIGRATHERM GFA10
300 x 1220 x 1830 mm	600 x 600 x 3300 mm	400 x 500 x 1230 mm	6.0 x 1220 x 25000 – 30000 mm	11.5 x 1270 x 25000 – 30000 mm
400 x 500 x 3500 mm	610 x 760 x 1830 mm			
500 x 500 x 1830 mm	610 x 760 x 2030 mm			
500 x 500 x 2750 mm	610 x 760 x 2540 mm			

Other grades and dimensions on request. Please contact us.

You will find the dimensions in inches in the data sheet enclosed with the brochure.



↑ **SIGRAFINE profiles**
for tin bath walls

Float glass requires consistent high quality, absolute precision, flawless appearance, and the highest purity possible. Our materials and components for the continuous manufacture of large-format float glass are impressive in every respect.

SGL Group's portfolio is tailored to meet the demanding requirements and highly specific machinery used by float glass.

In view of the high temperature of the tin bath of 1100 °C (2000 °F), a graphite edge insert is essential. The main reasons for using extruded graphite here are its high corrosion and abrasion resistance.

Our ash-reduced grades such as SIGRAFINE R7550 have a particularly long service life, which helps keep plant maintenance costs to a minimum. For more demanding requirements, we supply special impregnations (NOX treatment) that further increase oxidation resistance and consequently the service life of the materials and components.

Our precision components and systems produced from SIGRAFINE fine-grain graphites offer maximum process reliability. Typical examples include ready-to-use profiles and barriers, sometimes in extreme lengths, for tin bath walls. SIGRATHERM soft felts hereby ensure the thermal insulation. This also makes the most of the advantages of extruded graphite in conveying systems, rollers, and scrapers. In the refining section, it is combined with isostatically pressed graphite.

+

Specialty graphites and components for the refractory industry

Standard dimensions of our main grades for refractory manufacture

Extruded graphite		Vibration-molded graphite	
SIGRAFINE HLM		SIGRAFINE MKUN	
300 x 1220 x 1830 mm	610 x 760 x 1830 mm	610 x 720 x 2700 mm	
500 x 500 x 1830 mm	610 x 760 x 2030 mm	630 x 1300 x 1420 mm	
500 x 500 x 2750 mm	610 x 760 x 2540 mm		
600 x 600 x 3300 mm			

Other grades and dimensions on request. Please contact us.

You will find the dimensions in inches in the data sheet enclosed with the brochure.

In addition to thermal stability and thermal shock resistance, our graphites also offer high impact strength, wear resistance, and mechanical strength as well as excellent corrosion resistance. Moreover, they feature low wettability and adhesion in contact with molten materials. Material properties like these make our graphite quick and easy to machine.

Optimum design for molds and ovens in the glass industry.

We supply a broad range of extruded and vibration-molded specialty graphites for sheets and molds used in the production of melt-cast zirconium oxide refractory bricks. Even casting molds with complex geometries can be produced from our materials without problems. And our finished refractory bricks are of top quality – free of contaminants or surface imperfections. In addition, the casting molds produced from extruded and vibration-molded graphites can be reused several times, thanks to optimized oxidation properties.

In addition to our standard sizes, which we supply in lengths up to 3500 mm (138"), we also produce made-to-measure blocks tailored to the size requirements of our customers' specific applications.

Material data for SIGRAFINE® die-molded carbon and isostatic graphite

Typical properties	Units	Die-molded carbon SIGRAFINE R7141H	Isostatic graphite SIGRAFINE R7340	Isostatic graphite SIGRAFINE R7510
Average grain size	µm	150	15	10
Bulk density	g/cm ³	1.55	1.72	1.83
Open porosity	Vol. %	18	15	10
Average pore size	µm	12	2.2	1.8
Coefficient of permeability (20 °C)	cm ² /s	12	0.25	0.06
Rockwell hardness		HR _{10/60} 90	HR _{10/100} 80	HR _{5/100} 90
Electrical resistivity	µΩm	50	12	13
Flexural strength	MPa	15	45	60
Compressive strength	MPa	50	90	130
Dynamic modulus of elasticity	GPa	10	11	11.5
Thermal expansion (20 – 200 °C)	10 ⁻⁶ K ⁻¹	3.1	3.2	4.2
Thermal conductivity (20 °C)	Wm ⁻¹ K ⁻¹	4	105	105
Ash content	ppm	≤ 2000	200	200

Values may vary depending on block size.

Material data for SIGRAFINE® extruded and vibration-molded graphite

Typical properties	Units	Extruded graphite SIGRAFINE HLM		Vibration-molded graphite SIGRAFINE MKUN	
Average grain size	mm	0.8		0.8	
Bulk density	g/cm ³	1.72		1.67	
Electrical resistivity	µΩm	8	⊥ 10	10	⊥ 12
Flexural strength	MPa	14	⊥ -	10	⊥ 10
Compressive strength	MPa	-	⊥ -	25	⊥ 25
Thermal expansion (20 – 200 °C)	Wm ⁻¹ K ⁻¹	2.1	⊥ 3.0	2.3	⊥ 3.2
Ash content	ppm	≤ 800		≤ 700	

|| parallel to longitudinal direction of grain, ⊥ vertical to longitudinal direction of grain.

Values may vary depending on block size.

Material data for SIGRABOND® carbon fiber-reinforced carbon

Typical properties	Units	SIGRABOND Standard	SIGRABOND Performance
Bulk density	g/cm ³	1.50	1.50
Flexural strength	MPa	150	200
Dynamic modulus of elasticity	GPa	60	70
Interlaminar shear strength	MPa	8	8
Ash content	ppm	1000	1000

You will find the US-units in the data sheets enclosed with the brochure.



SGL Group – The Carbon Company. A leading global manufacturer of carbon-based products.

- *Unique product portfolio*
- *Innovative technologies and solutions*
- *Production sites close to sales markets*
- *Technology & Innovation Center in Germany
with international networks*

We have wide-ranging expertise in raw materials, advanced manufacturing processes, and long-standing application and engineering know-how.


We have a comprehensive portfolio of carbon, graphite, and carbon fiber products and our integrated value chain covers everything from carbon fiber to composites. With a global sales and distribution network and modern production sites in Europe, North America, and Asia, we are close to our customers throughout the world.


We use this broad base to offer our customers the best solutions possible. That's how we live up to our claim: **Broad Base. Best Solutions.** This claim is also upheld by our corporate SGL Excellence philosophy of continuous improvement.



More information can be found by visiting:

www.sglgroup.com

 [sglgroup](#)

 [sglgroup](#)

Contact

EUROPE/MIDDLE EAST/AFRICA
SGL CARBON GmbH
Drachenburgstrasse 1
53170 Bonn/Germany
gms-europe@sglgroup.com

AMERICAS
SGL CARBON LLC
900 Theresia Street
PA 15857 St. Marys/USA
gms-americas@sglgroup.com

ASIA/PACIFIC
SGL CARBON Far East Ltd.
12 Fl, Shanghai Oriental Plaza
31 Wujiang Road
Shanghai 200041/PR China
gms-asia@sglgroup.com

® registered trademarks of SGL CARBON SE

07 2015/0 2NÄ Printed in Germany

This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should therefore not be construed as guaranteeing specific properties of the products described or their suitability for a particular application. Any existing industrial property rights must be observed. The quality of our products is guaranteed under our "General Conditions of Sale".



Graphite Materials & Systems
SGL CARBON GmbH
Soehnleinstrasse 8 | 65201 Wiesbaden/Germany
www.sglgroup.com/gms



SGL GROUP
THE CARBON COMPANY