Broad Base. Best Solutions.

SGL GROUP
THE CARBON COMPANY

GRAPHITE MATERIALS AND SYSTEMS

Specialty Graphites for Electrical Discharge Machining

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, 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 electrical discharge machining (EDM)

Specialty graphite electrodes are becoming increasingly important in EDM when very high precision and advanced design are required. Our innovative products and material solutions make us the partner of choice.

← Detail rib electrode made from SIGRAFINE R8650

Specialty graphites for electrical discharge machining.

Graphite is now widely used for electrical discharge machining in production and moldmaking because it offers key advantages:

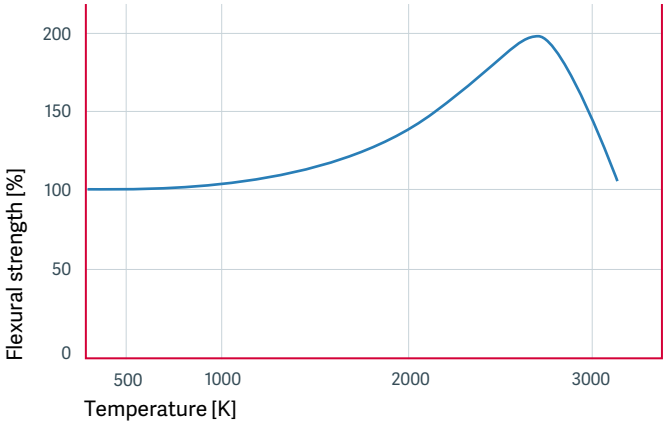
- **Time and cost saving due to low wear**
- **Less complex milling tools and easier machining**
- **Exceptionally suitable for fine detailed geometries and high-quality surface finishes (micromachining)**
- **Low thermal influence of the electrode and component to the effect of heat**

Specialty graphites for EDM electrodes

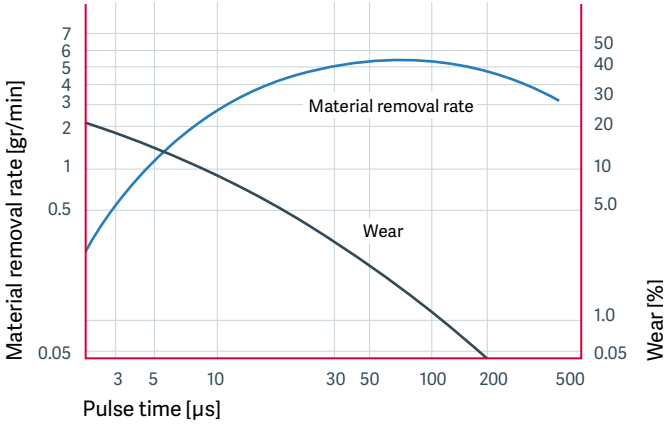
Our isostatically pressed fine-grain graphites are appreciated for their outstanding properties in EDM processes.

They permit high material removal rates with low electrode wear and have high flexural strength at elevated temperatures.

Percentage increase of flexural strength of graphite



Erosion behavior of graphite

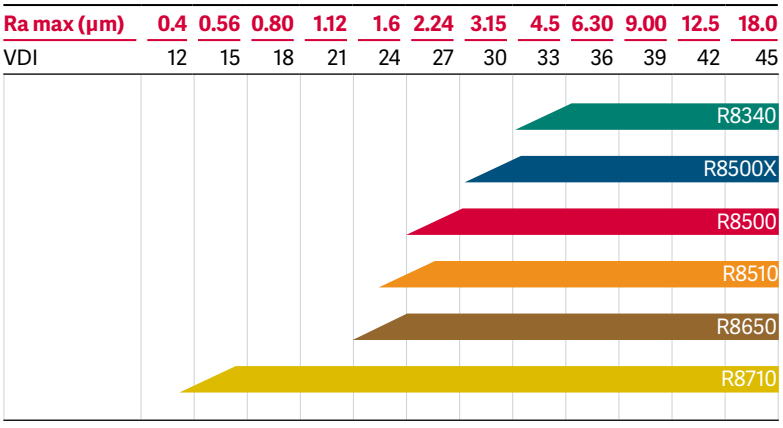


Workpiece material:	Steel
Electrode polarity:	+
Peak performance:	60 A
Pulse duty factor:	50 %
Electrode size:	ø 20 mm

By selecting the most suitable material, even the highest surface finish requirements can be easily fulfilled.

We have long-standing EDM expertise and know what is important. With our wide range of materials and technical support, we can help OEMs and end users achieve the best results.

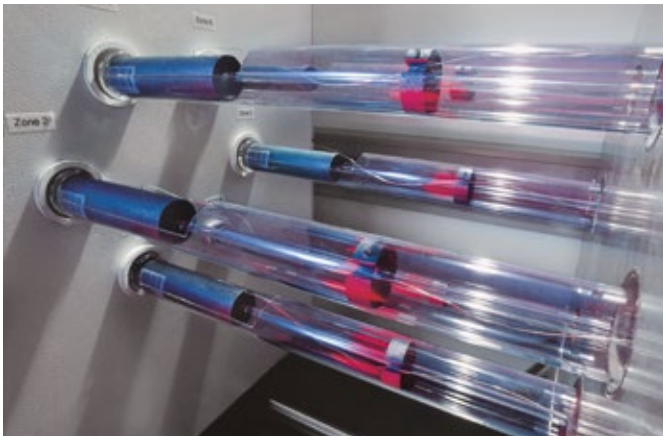
Achievable surface roughness depths with our SIGRAFINE® fine-grain graphites



The achievable surface finish depends on generator technology as well.

← Graphite electrode for the production of aircraft turbine blades

To ensure consistent quality, every stage of our production process is strictly monitored. Every block is tested and documented.
The measures range from accurate incoming goods checks and raw material tests to continuous monitoring of process parameters taken from each individual block leaving the production process. In addition, clear identification marks make every product fully traceable back through every stage of the production process.



↑ Thermal expansion testing

***↑ Chemical analysis** in one of our special laboratories*

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All test laboratory work, such as comparative measurement, is offered to our customers as an independent service.

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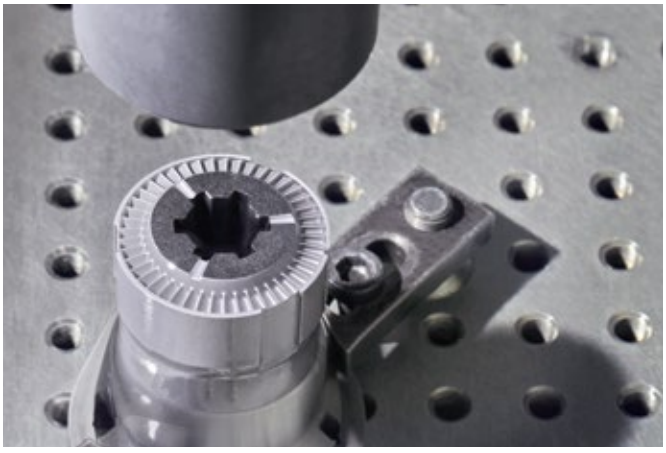
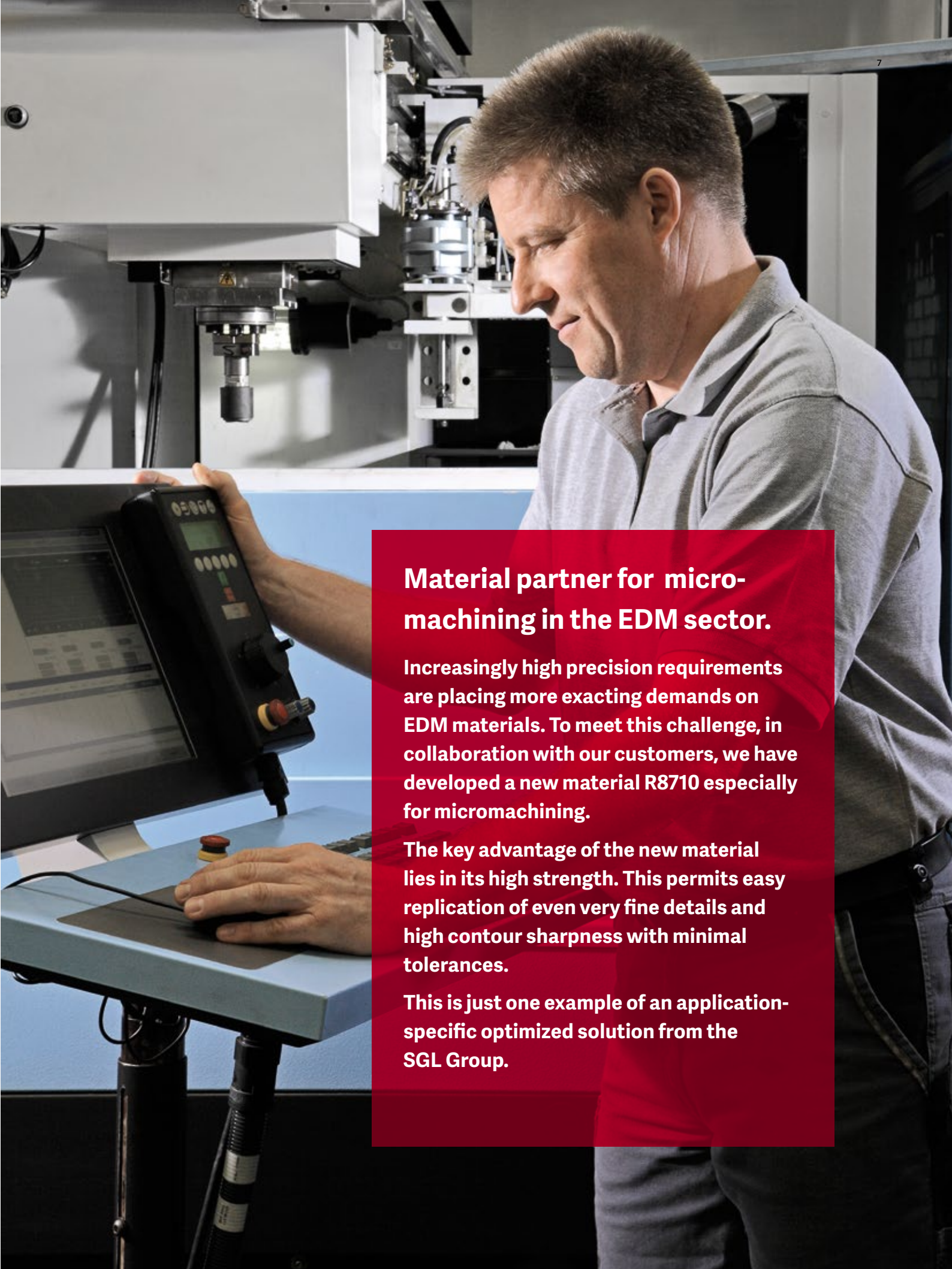
Video: Isostatic graphite, a key product for the high-tech industry.
YouTube sglgroup



***↑ Pressing die** eroded by a micromachined graphite electrode*

SIGRAFINE® isostatic graphites for EDM electrodes

Applications	R8340	R8500X	R8500	R8510	R8650	R8710
Block/rod/mass electrodes	•	•	•	•	•	•
Standard electrodes	•	•	•	•	•	•
Ready-to-run electrodes	•	•	•	•	•	•



Material partner for micro-machining in the EDM sector.

Increasingly high precision requirements are placing more exacting demands on EDM materials. To meet this challenge, in collaboration with our customers, we have developed a new material R8710 especially for micromachining.

The key advantage of the new material lies in its high strength. This permits easy replication of even very fine details and high contour sharpness with minimal tolerances.

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

SIGRAFINE® fine-grain graphites for moldmakers

Versatile, reliable, efficient.

Our comprehensive range of fine-grain graphites covers all EDM requirements, right through to high-performance milling (HPM). The speed at which graphite can be machined is limited only by the performance of the computer and the machining system, but not by the material itself. Besides very high cutting speeds, feed rates of more than 10 m/min can be achieved, depending on the electrode geometry. These parameters are comparable with those for aluminum and plastics.

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

Working with our graphites does not require any special knowledge.
Modern EDM machines are already designed for the specific quality and properties of our various graphite grades.
To give our customers added security, we assist them every step of the way in individual projects, from material selection to on-site technical support.

↑ Standard ready-to-run electrode

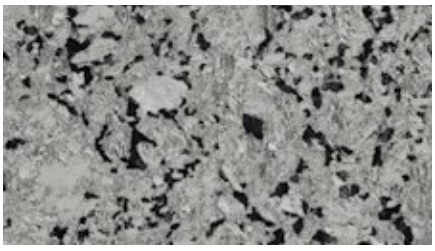
Standard dimensions of our SIGRAFINE® isostatic graphite grades for EDM

SIGRAFINE R8340	SIGRAFINE R8500X SIGRAFINE R8500	SIGRAFINE R8510	SIGRAFINE R8650	SIGRAFINE R8710
1550 x 410 x 200 mm 1230 x 500 x 400 mm 610 x 500 x 400 mm	1230 x 500 x 400 mm 610 x 500 x 400 mm	1230 x 1020 x 330 mm 1230 x 500 x 400 mm 610 x 500 x 400 mm	1230 x 480 x 260 mm 610 x 480 x 260 mm	610 x 390 x 190 mm
ø 150 x 1230 mm ø 180 x 1230 mm ø 200 x 1230 mm ø 225 x 1230 mm ø 250 x 1230 mm ø 280 x 1230 mm ø 320 x 1230 mm ø 350 x 1230 mm ø 380 x 1230 mm ø 420 x 1230 mm	Please ask for the list of dimensions of our standard ready-to-run electrodes.			

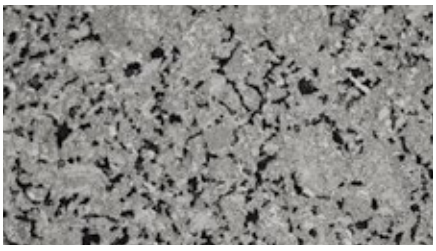
The dimensions are minimum sizes.

Structure/particle sizes of our electrode graphites

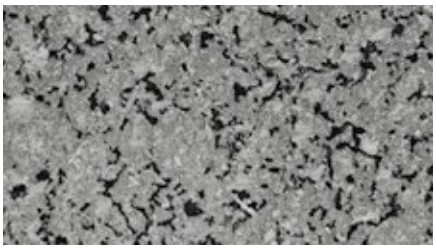
100 µm



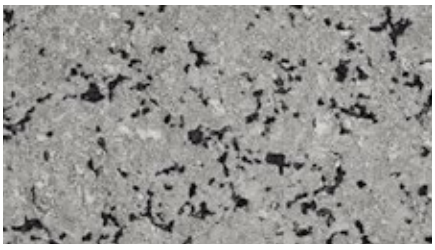
R8340 | Economic roughing grade



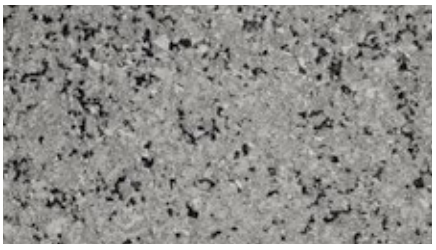
R8500X | Roughing and pre-finishing grade



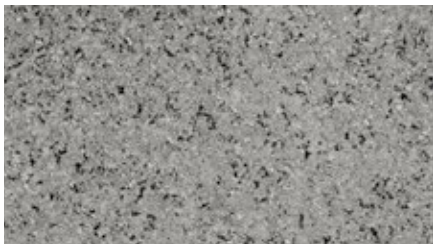
R8500 | Universal moldmaking material



R8510 | Wear-resistant fine-grain graphite for high requirements



R8650 | Finishing grade for very high replication of detail



R8710 | Fine finishing material to achieve the best surface quality, with comparatively high material removal rates for a fine finishing grade

We continue to further develop our materials in compliance with industry-specific standards.
Our customers benefit from ongoing material optimization, no matter in which industry they operate: e. g. automotive, aerospace, medical technology or micromachining, where material performance plays a key role.

Material data for our SIGRAFINE® electrode graphites

Typical properties	Unit	R8340	R8500X	R8500	R8510	R8650	R8710
Bulk density	g/cm³	1.72	1.75	1.77	1.83	1.84	1.88
Open porosity	Vol. %	15	14	14	10	10	10
Average grain size	µm	15	12	10	10	7	3
Medium pore entrance diameter	µm	2.2	2.0	1.8	1.8	1.1	0.6
Coefficient of permeability	10^{-2} cm²/s	25	15	25	6	2	1
Rockwell hardness		$HR_{10/100}$ 80	$HR_{5/100}$ 70	$HR_{5/100}$ 70	$HR_{5/100}$ 90	$HR_{5/100}$ 95	$HR_{5/100}$ 105
Flexural strength	MPa	45	45	50	60	65	85
Dynamic modulus of elasticity	GPa	11	10.5	10.5	11.5	12.5	13.5
Resistivity	µΩm	12	15	14	13	14	13
Thermal conductivity (20 °C)	$Wm^{-1}K^{-1}$	105	80	90	105	95	105
Thermal expansion (20 – 200 °C)	$10^{-6}K^{-1}$	3.2	4.2	4.2	4.2	4.1	4.7
Ash content	max. %	0.02	0.02	0.02	0.02	0.02	0.02

These are average values.

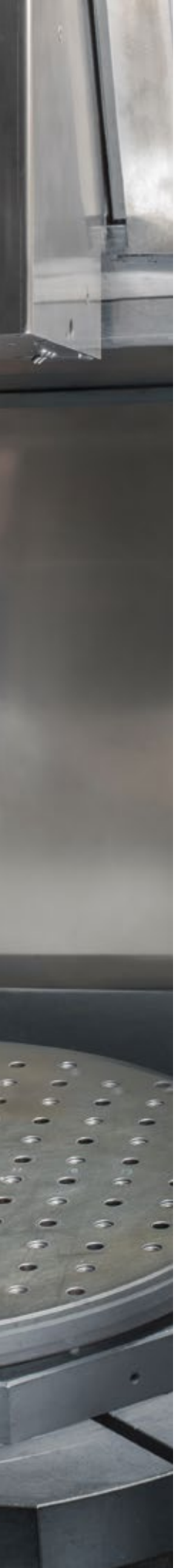
We will find the best solution – in partnership with you.

The fascinating potential of carbon as a material excites us and inspires us to develop optimum solutions in partnership with our customers.

With our comprehensive material portfolio and valuable specialist know-how, we can manufacture tailored products – even for the most challenging applications.

Consistently high quality, a global presence, innovative strength, and the extensive experience of our employees make us a reliable partner to our customers.

Whatever challenges you face, together we will find the best solution.



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*

← Manufacture of a dashboard mold using a specialty graphite electrode

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:
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