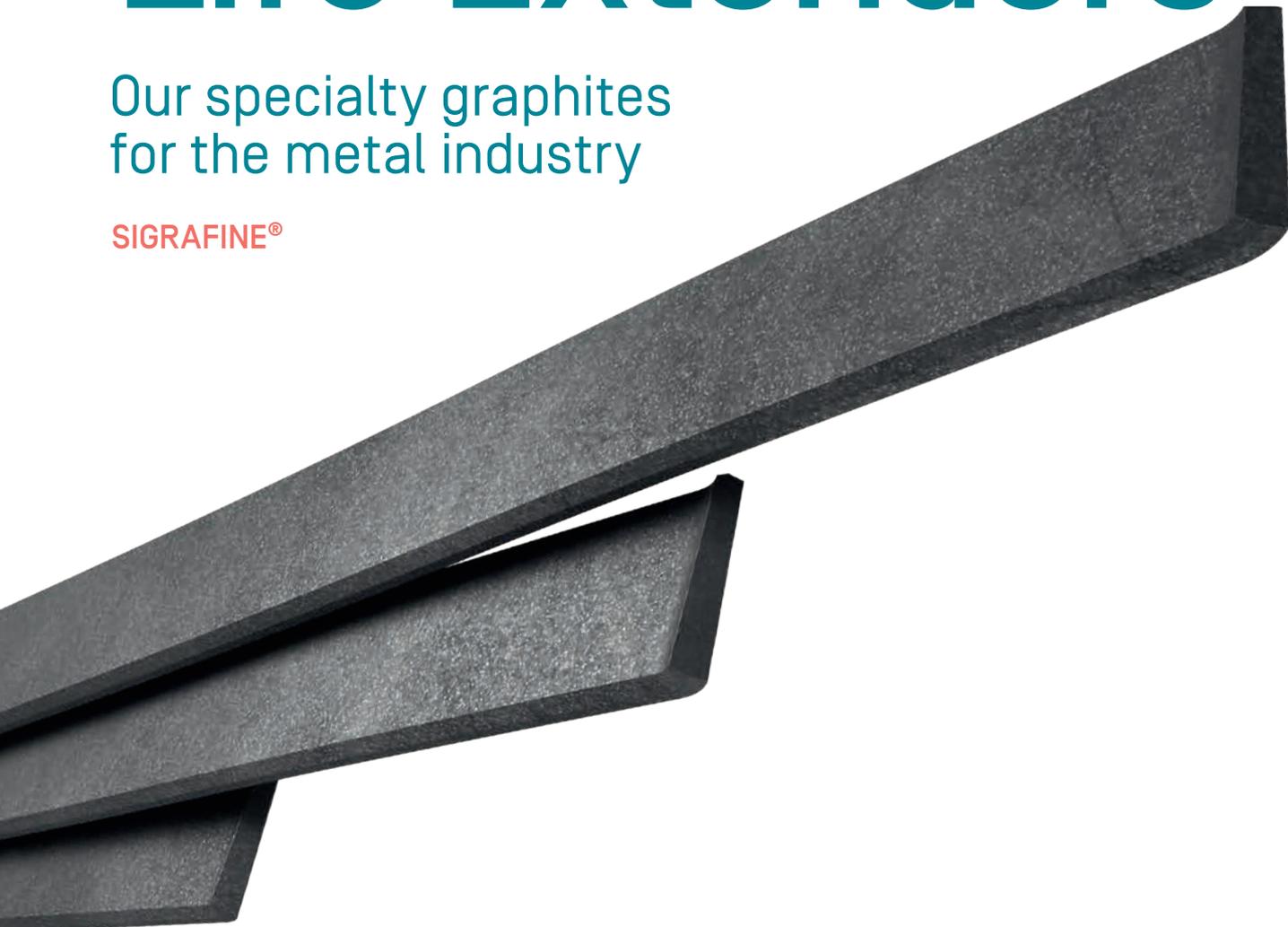


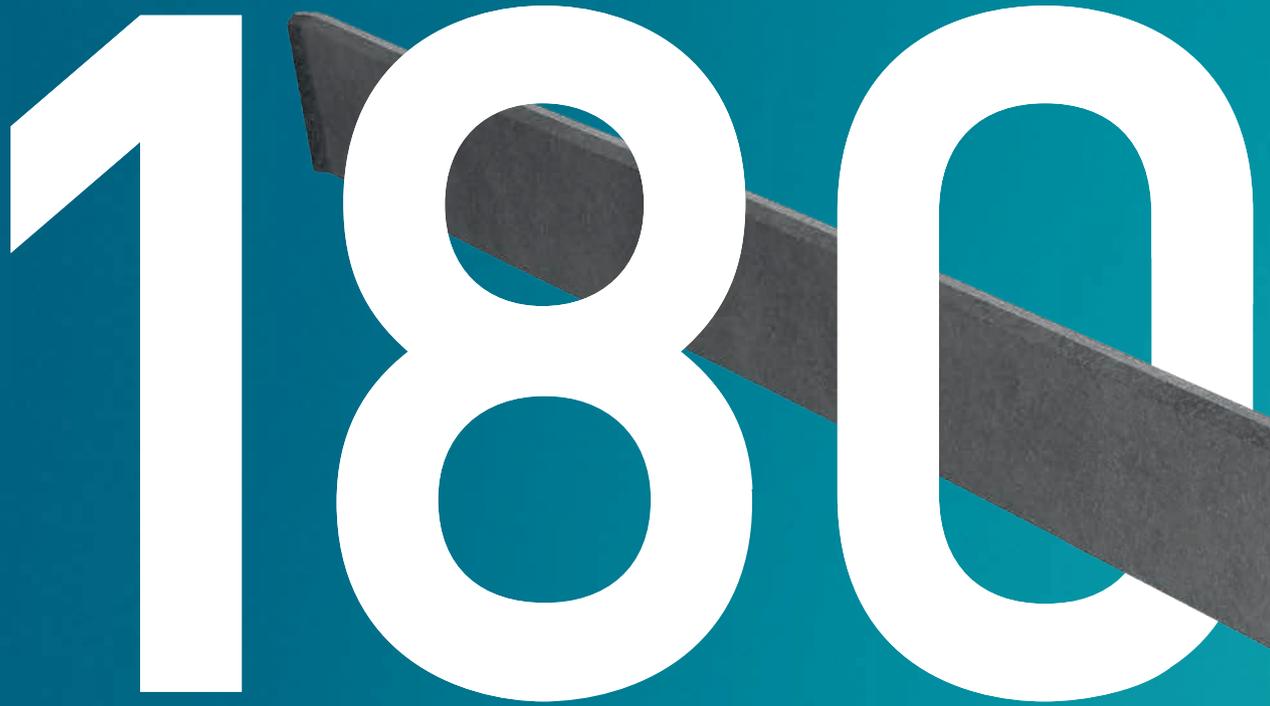


The Service Life Extenders

Our specialty graphites
for the metal industry

SIGRAFINE®





1800

SIGRAFINE® HLM-ENOX Service life nearly doubled

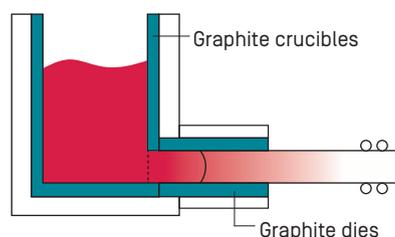
Rotating degassing units are exposed to highly corrosive conditions which restrict their service life. Consequently, we have developed SIGRAFINE HLM-ENOX, a new type of material which has proved to extend the unit's service life by 80% over standard materials thanks to its innovative formulation. This characteristic of the material is unrivalled on the markets and results in significant cost efficiency gains – thereby positioning HLM-ENOX as a genuine service life extender.

0%



Our specialty graphites for the metal industry

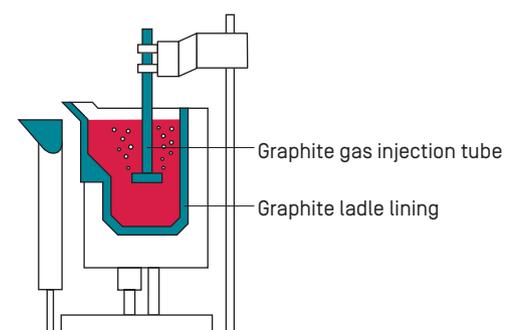
When melting, casting and molding in very high temperature ranges, the requirements of components and systems rise in line with the greater demands made on material purity, design, product lifetime and cost-efficiency. Specialty graphites are increasingly taking centre stage.



Continuous casting	
Typical applications	<ul style="list-style-type: none"> • Rounds • Strips • Wires • Profiles
Products of SGL Carbon	<ul style="list-style-type: none"> • SIGRAFINE® isostatic, vibration-molded, die-molded and extruded graphites
Materials used by SGL Carbon	<ul style="list-style-type: none"> • Cooling plates • Dies • Crucibles • Casting molds • Semi-finished products (rounds / squares)

Your benefits

We support the metal industry with innovative and powerful materials. Thanks to their technical characteristics, these materials ensure quality, cost-effectiveness and environmental compatibility, from the achievement of the highest purity grades through to the streamlining of mechanical processing and on to saving on flushing gas. In addition, our materials and products enhance the performance of systems and processes in numerous applications.



Aluminum treatment

- Refinement of aluminum melts and their alloys

-
- SIGRAFINE®
isostatic, vibration-molded, die-molded and extruded graphites

-
- Gas injection tubes
 - Rotating gas distribution systems (shafts, rotors)
 - Casting rings
 - Ladle linings
 - Tapping spouts
-

SIGRAFINE®

fine-grain graphites for continuous casting

Our products are designed for different casting techniques and metals. They invariably impress with their consistent material characteristics such as their thermal conductivity, chemical and thermal resistance and their high strength.



Dimensional accuracy and surface quality

High dimensional accuracy and outstanding surface quality are crucial for dies used in continuous casting

Broad range of applications

Our dies are used in vertical, horizontal and up-casting. The molds are suitable for melting various metals and alloys: copper, aluminum bronze, tin bronze, brass, nickel silver, cupro-nickel and precious metal as well as special alloys.

Exceptional range of formats and special dimensions

We supply round dies from 150 mm to 450 mm in diameter – up to 1100 mm for special dimensions. In the case of strip dies and square dies, the dimensions range from 330 x 510 x 1230 mm to 410 x 200 x 1550 mm.

We make all dies to customer designs and specifications to the utmost precision, thereby achieving extremely low surface roughness and consistent material quality.

Proven parameters

We will advise you on the selection of the right grade of graphite. We take all the decisive factors into account, such as the characteristics of the metal or alloy to be cast, the desired shape and its dimensions, the volume of metal to be cast as well as the design and special conditions of the plant. Therefore, please be sure to contact us at an early stage.

Our specialty graphites exhibit relevant material characteristics:

- Low surface wettability
- Good lubrication properties
- Good thermal conductivity
- High strength
- High thermal and chemical resistance
- Excellent thermal shock resistance
- Low thermal expansion
- Good workability

SIGRAFINE® specialty graphites for aluminum treatment

Thanks to their material properties such as extreme corrosion resistance and stability at high temperatures and temperature shocks, our specialty graphites are ideal materials for gas flushing treatments and contribute to a significant service life extension.





↑ SIGRAFINE rotor heads for rotating gas distribution systems

Flushing enhances quality

In the casting of aluminum melts, gas flushing treatments can deliver significant quality improvements. This is mainly achieved by reducing the hydrogen content and oxidic impurities. This type of cleaning avoids cracks and cavities, resulting in good mold-filling properties and ensuring that the casting exhibits a dense structure, free of pores.

The role of graphite

Gas injection tubes and gas distribution systems made of graphite are particularly well suited to this type of cleaning as the graphite proves resistant to the gases utilized (flushing gases), namely chlorine, nitrogen and argon as well as their mixtures and further aggregates.

Gases used for flushing aluminum melts

Chlorine

Chlorine has long ranked as the most common flushing gas for the chemical and concurrent mechanical cleaning of any aluminum melt present. This gas is used particularly for recycled aluminum.

Nitrogen

Nitrogen effects the mechanical cleaning of aluminum melts both through the flow initiated and through partial pressure difference. This is absolutely sufficient for many requirements. In practice, it is usually combined with other gases (up to 5% chlorine).

Argon

While this gas achieves a good flushing effect, hardly any alloy components are removed. Here, too, it is usually combined with chlorine, particularly if rotating gas injection systems are employed.

Specialty graphites for degassing tubes and gas distribution systems

Thermal, mechanical and chemical stability

When immersed in the melt, the graphite component is raised from room temperature to several hundred degrees Celsius in fractions of a second. At the same time, it is subjected to the cold flushing gases. The application itself requires a high degree of strength as the rotating gas distribution systems are immersed in the melt while turning. In addition, chemical resistance to the highly corrosive environment must be guaranteed.

Advantages of our specialty graphites in flushing with gas

- Resistant to fast changes in temperature
- Stability at high operating temperatures
- Resistance to molten metals and highly corrosive flushing gases

Improvement in service life thanks to material benefits

In addition, our HLM-NOX and HLM-ENOX brands exhibit low permeability and non-wettability by non-ferrous metal melts. This combination of properties leads to demonstrable improvements in service life of up to 180 %.



↑ Rotating degassing unit



↑ Heating element block for degassing systems

Your preferential partner for a wide variety of systems and requirements

Thanks to our extensive, in-depth knowledge in the development of anti-oxidation impregnations in connection with our standard portfolio, we offer solutions for systems of all sizes. In addition, we are experienced design partners when it comes to effective solutions for gas flushing treatments. We will also provide active support as your partner in trouble shooting for any possible faults.

We enable special dimensions

Electrodes for roughing up aluminum surfaces represent a good example of the capabilities of our standard portfolio. Here we are capable of realising lengths of up to 2,900 mm. We have also supported the design of crucibles with a format of 250 x 1000 x 2300 mm.

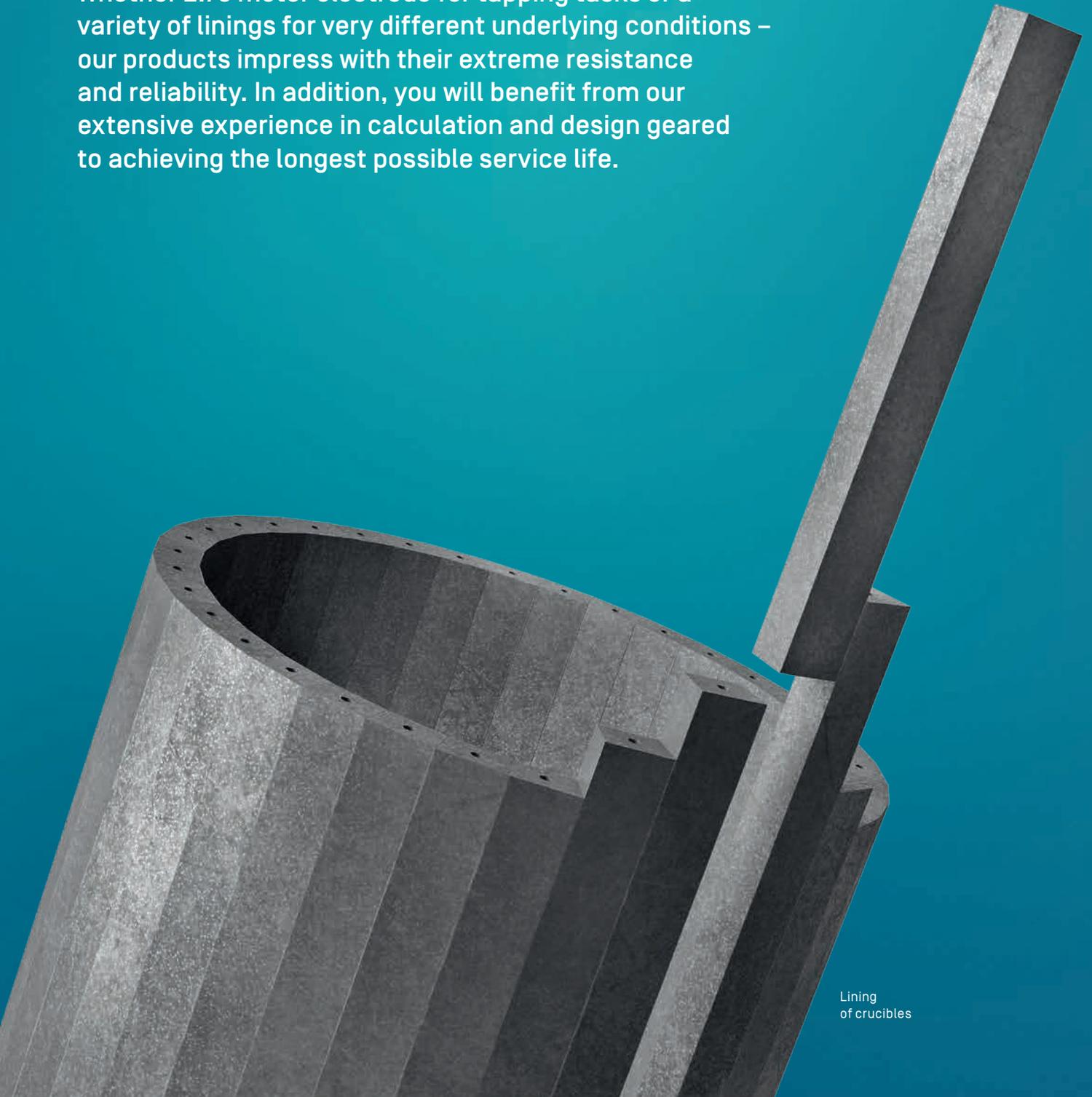
Innovation in shaping

With our ISO trademark R4800 - which is also deployed in the aluminum industry - we have developed a brand considered to be unrivalled on the markets. This specialty graphite which is used for the production of casting rings for casting tables, significantly improves the accuracy of the shaping stage in the manufacture of cast aluminum ingots - particularly when considering the surface quality of the ingot cast. Consequently, all leading systems manufacturers (OEMs) are relying on R4800 today.

SIGRAFINE®

fine-grain graphites for melt treatment

Whether 2.75 meter electrode for tapping tasks or a variety of linings for very different underlying conditions – our products impress with their extreme resistance and reliability. In addition, you will benefit from our extensive experience in calculation and design geared to achieving the longest possible service life.



Lining
of crucibles

Cost-effectiveness factor

In view of the high cost of mining ore, the following process steps are of decisive economic relevance for the metal industry. The challenge is to extract the maximum amount of metal from the mined material.

Graphite is first choice in thermal processes

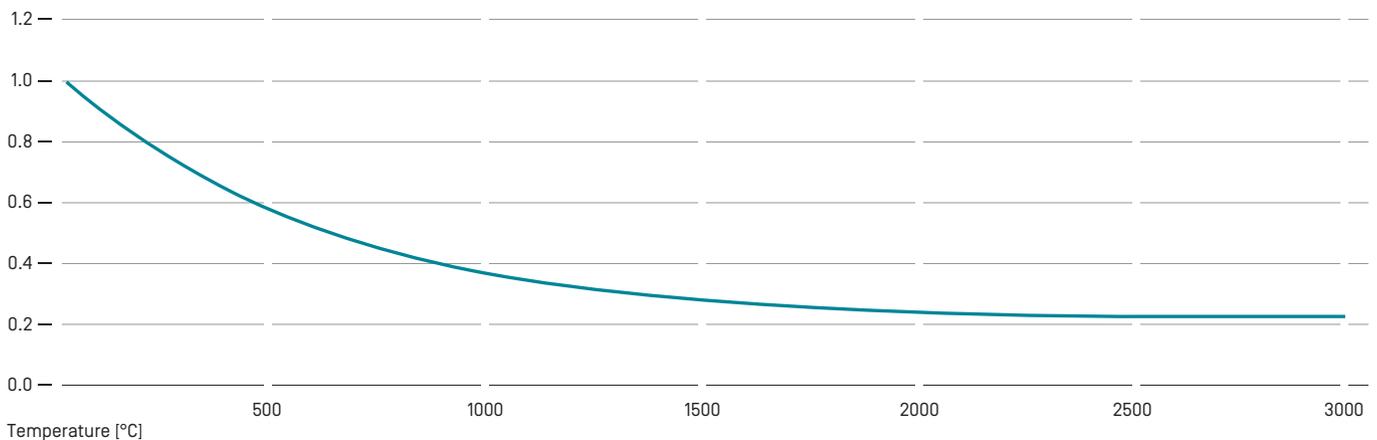
Mechanical, chemical and thermal treatments and extraction processes can all be used for this purpose. In the case of thermal processes, graphite is the material of choice and it plays a decisive role thanks to its specific material properties.

Properties of our fine graphites

- Resistant to high application temperatures
- High thermal shock resistance
- Low wettability
- Low permeability
- Good value for money

The use of graphite is ideal as its thermal conductivity falls as melting temperatures rise.

Relative thermal conductivity RT (value = 1)



Electrodes for tapping the furnace



↑ Tapping electrode

A tough task

The melt is poured into ladles via tapping spouts. The furnace must first be opened, however, by means of tapping electrodes (stinger pencils). The charged electrodes with a diameter of 75 millimeters and a length of 2,750 millimeters create an arc which discharges the refractory material at the prescribed opening thereby enabling the melt to run off.

2.75 meters – our manufacturing master class

The manufacture of stinger pencils presents a major challenge as these extremely long, thin objects can easily bend. Based on our experience with the material and in manufacturing, we developed a type of graphite in which the tendency to sag remains under 0.5 cm in terms of the total length – clearly the top performer in its class.



Advantages of our tapping electrode of SIGRAFINE fine-grain graphite

The combination of material and length we offer allows:

- it to be guided precisely to the opening by the operator
- a greater safety distance from the furnace to be maintained

Further advantages are:

- Uniform resistance and arcing behavior
- Less time spent on changing the electrode
- Longer cycle times
- Easy workability for establishing contact

Lining elements and heat-retaining electrodes



↑ Tapping spout

Fireproof and chemically resistant

Once poured off, the melt flows into the designated ladle. To protect its steel body, it is given a lining of refractory material. Graphite is the preferred material for this purpose although, it must be ensured that it does not bond with the melt as impurities must absolutely be avoided. Moreover, the formation of a bond with the refractory cement which fixes the graphite lining in the steel body must not be put at risk.

Our specific graphite types for varying conditions

Depending on the parameters of the melt process and the properties of the metal or alloy concerned, different grades of graphite will be suitable for the lining. We offer a broad range of graphite types including variable post-impregnation grades and dimensions, an notably large formats such as 600 x 600 x 3300 mm and 500 x 500 x 2750 mm.

Benefit from our extensive, in-depth knowledge of materials and processes

With recommendations on the design of the liners and their assembly, we can help in optimizing processes and ultimately extending service lives. The number of castings can be substantially increased by the following factors:

- The number of liners spread over the area of the ladle
- The design of the base plates taking account of their assembly options on site
- avoidance of gaps between liner and base
- Detection of premature wear and tear through oxidation and taking counteractive measures through design changes
- Selection of the right grade of graphite depending on the melt conditions

We also supply linings of hard coal which are required for certain process conditions. Here, too, we can realize the same formats and offer advice on design.



↑ Heat retention electrode

Heat retention electrodes

The melt has to be kept warm after processing in order to avoid any change in viscosity or premature stiffening. Heat-retaining electrodes are used for this purpose. Our rounds of extruded fine-grain graphite are particularly well suited for such assignments.

Calculation and design

The preceding electrical calculation has a substantial influence on the design of the finished piece. This calculation follows the following steps:

- identify the existing electrical supply (transformer)
- determine the graphite grades available
- calculate the electrical resistance

From these steps we develop a proposal for the design, taking the spatial conditions on site into account.

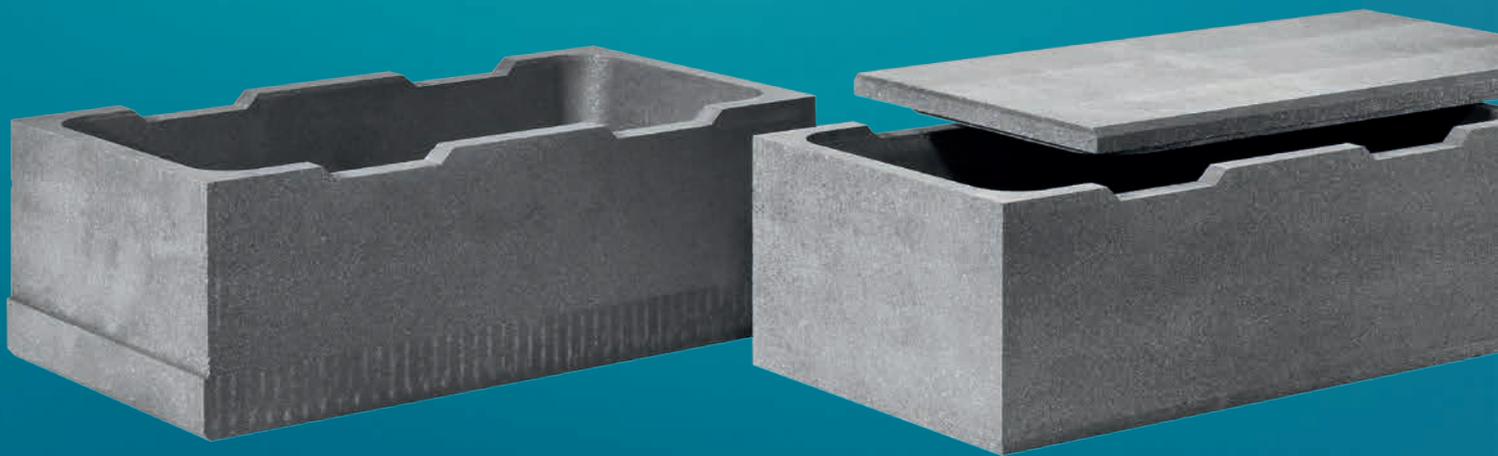
Optimized service life

In the case of heat-retaining electrodes, their service life can be significantly increased by the choice of the right grade of graphite as well as further treatments such as an anti-oxidation impregnation.

SIGRAFINE®

specialty graphites for powder metallurgy

For the manufacture of cutting tools and polycrystalline diamonds, we offer a broad range of equipment parts and shaping elements which impress with their excellent thermal and chemical properties.



Relevance of graphite

For the manufacture of cutting tools from hard metal powder in the machining industry as well as for mold making, charging containers are mainly required (so-called sintering trays or sinter boats). Their manufacture involves fine-grained graphite. In addition, we offer the entire range of equipment for the furnaces utilized in making the powder:

- Ladles
- Furnace muffles
- Linings
- Heating elements
- Combinations of carbon fibres and extruded graphite
- Thermal insulation (hard felts and film)

A single source provider

The material quality of our products is complemented by our extensive, in-depth knowledge of the pressure sintering process and the handling of high pressures and temperatures. For example, we also design the necessary components and supply the necessary calculations.

Manufacture of polycrystalline diamonds

Thanks to their sound properties, our graphites are also used for the manufacture of polycrystalline industrial diamonds (drill bits, PDC). The form for the actual drill head is determined from extruded graphite. Involving the addition of hard metal powder and high temperatures, the drill head is made from tungsten carbide. In this way, a matrix composite is created from hard metal and industrial diamond, a system consisting of carrier and cutter. We opt for isostatically pressed graphites to form the thread (details). This composite and the design affect the speed with which the drill head is able to remove the underlying rock, sand, etc. (rate of penetration, ROP).

Properties of our SIGRAFINE specialty graphites

- High dimensional stability
- High oxidation resistance
- Homogeneous material structure
- Good thermal conductivity and consistent electrical resistance

Our fine-grain graphites all stand for high mechanical strength, good lubrication properties as well as low static charge. Our purification furnaces, operated for this specific purpose, guarantee the purification levels our customers demand.

The diamonds are pressure sintered with a mixture of highly purified graphite powders and nickel, cobalt or iron. 5000 bar and 2000 °C are required for the synthesis. We use extruded graphite grades with multiple impregnations, low ash content as well as graphite foil. We can also offer coating solutions if needed.

Variety and service

In accordance with the wide-ranging application areas, we offer components manufactured for special customer requirements, as well as tailored solutions developed together with our customers to meet specific demands.

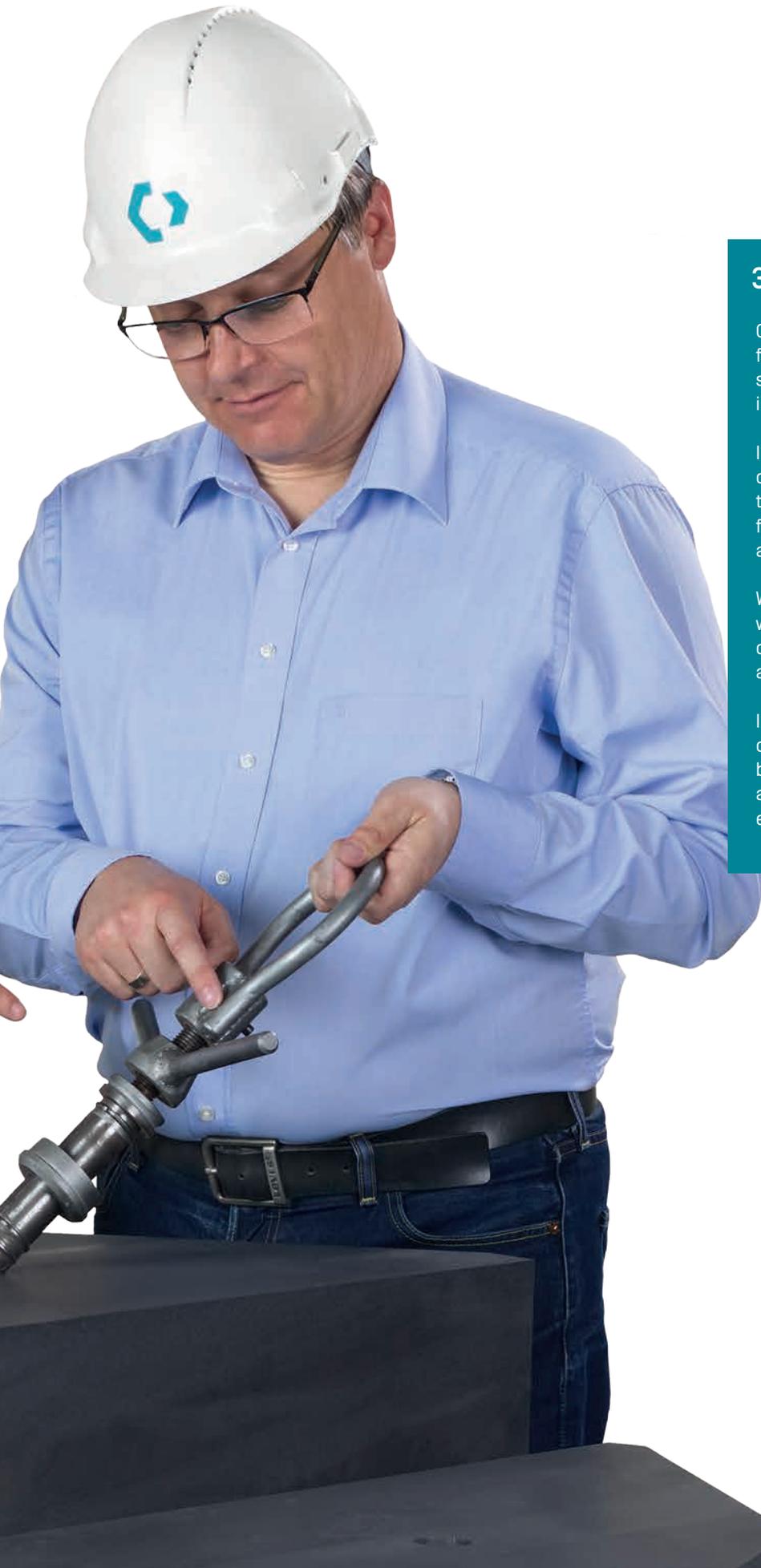
Successful together

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 is how most of our innovations and solutions come about – such as a device for the integrated installation of linings in ladles.





36 in one go

One of our customers used 36 linings of SIGRAFINE fine-grain graphite that we manufactured and supplied for lining their steel ladles; the linings were individually fitted to the interior wall of the ladle.

In order to reduce the risk of damaging the linings during installation or replacement as far as possible, the customer asked us to change the design for fitting the linings, a change that was intended to avoid the necessity to fit each lining individually.

We developed an integrated hoisting system in which all the linings are already joined together outside the ladle and then moved into the ladle as a unit and fitted there.

In this way, we were able to offer a solution to the customer's request that not only minimized possible installation damage but also saved a considerable amount of time, thereby helping to boost the efficiency of the production processes involved.

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 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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