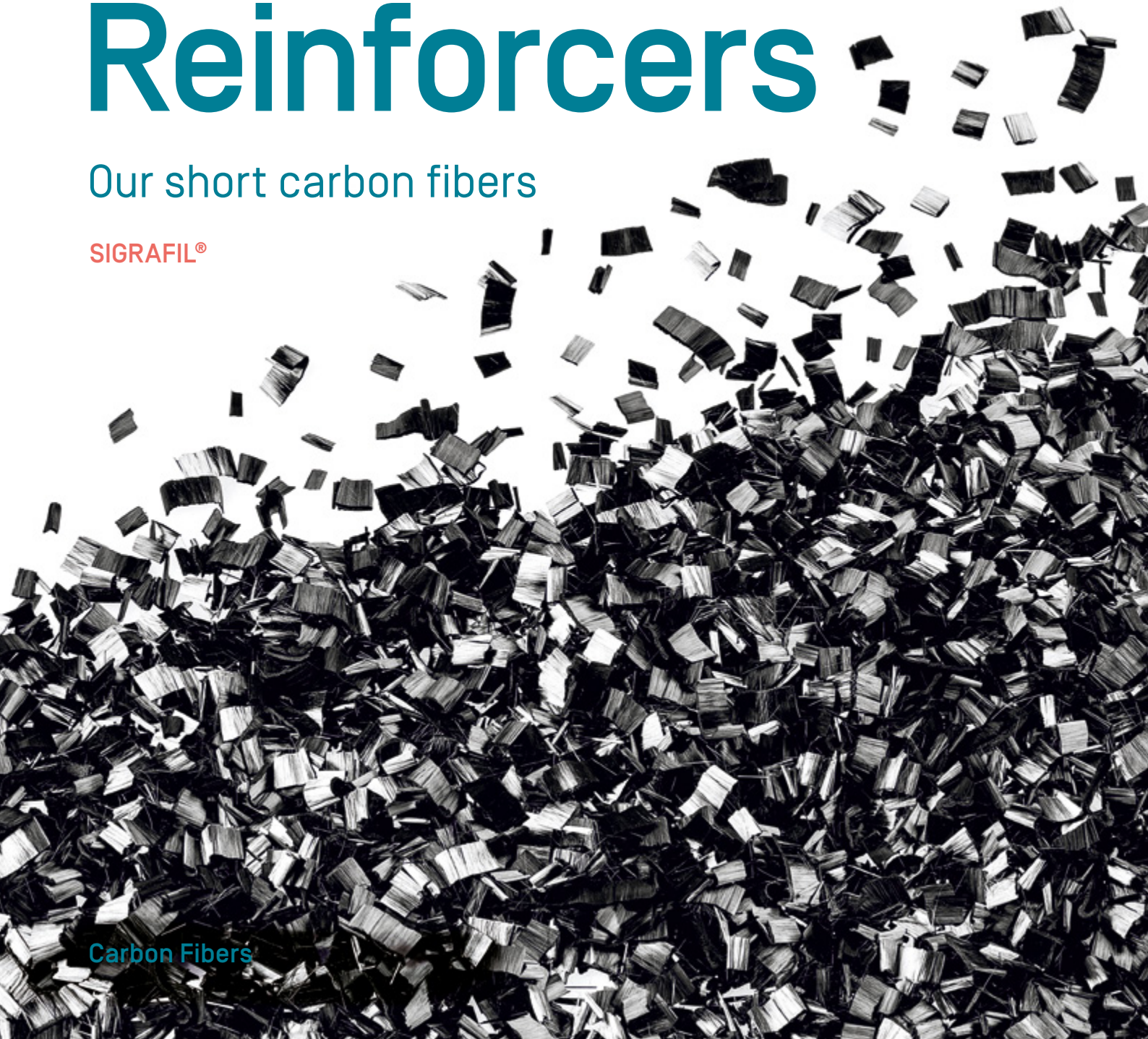
sgl carbon

The Reinforcers

Our short carbon fibers

SIGRAFIL®



Carbon Fibers

T

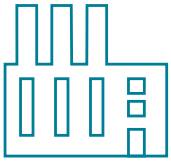
SIGRAFIL® short carbon fibers
The secret to top-strength composites

T 130 is the most common sizing system for our SIGRAFIL short carbon fibers. It is essential for effective strengthening of composites – especially for injection molding involving engineering thermoplastics. T 130 is based on polyurethane chemistry and ensures a strong connection between the fibers and the polymer matrix. This in turn ensures significantly better strength and stiffness in the final product. As part of the production process, sizing can have a massive impact. Without the proper sizing, chopped fibers can be soft and loose, which degrades the ability to handle or process the fibers. SIGRAFIL short carbon fibers do more than just reinforce composites. They support customer processes and ultimately the customer itself. Smart solutions from SGL Carbon – the real reinforcers.

130

Our short carbon fibers

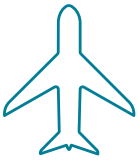
SIGRAFIL short carbon fibers are based on high-quality continuous carbon fiber tows from our own production lines. Each and every batch delivers our famously uncompromising quality, production consistency and material properties. Our customers benefit from SGL Carbon's unparalleled experience at all stages of the processing chain. SIGRAFIL short carbon fibers are proven performers in many industries around the world.



Market segments of our Business Unit Carbon Fibers	Automotive	Industrial Applications
Typical applications	• Interior components • Secondary structure components • Braking systems	• Injection molding applications • Process equipment • Packaging • Additive manufacturing for 3D printing • Buoyancy • Medical technology • Machinery and plant manufacture • Sports and leisure • Marine industry • Civil engineering
Typical products	• Injection-molded parts • Brake disks and brake pads	• Thermoplastic compounds • Hard-disk case • Electrostatically discharge floorings • Speciality papers • Conductive adhesives • Functional coatings • Refractory components • Fuel cells • Concrete reinforcement • Graphite electrodes
Materials used from SGL Carbon	• SIGRAFIL® chopped carbon fibers • SIGRAFIL® milled carbon fibers	• SIGRAFIL® chopped carbon fibers • SIGRAFIL® milled carbon fibers

Strong, stiff, light
Our short fiber products are indispensable tools in high-tech applications where material compatibility is just as crucial as strength and stiffness. In technical plastics such as polycarbonate, SIGRAFIL short carbon fibers outperform alternative fibers.

They offer a significantly higher stiffness to weight ratio and are thus popular in industries that require lightweight design, including automotive, aerospace, energy, and various other industrial applications.



Aerospace

- Secondary structure components
- Interior components
- Reduced weight components – glass fiber replacement

- Aircraft seat components
- Fasteners

- SIGRAFIL® chopped carbon fibers
- SIGRAFIL® milled carbon fibers

Energy

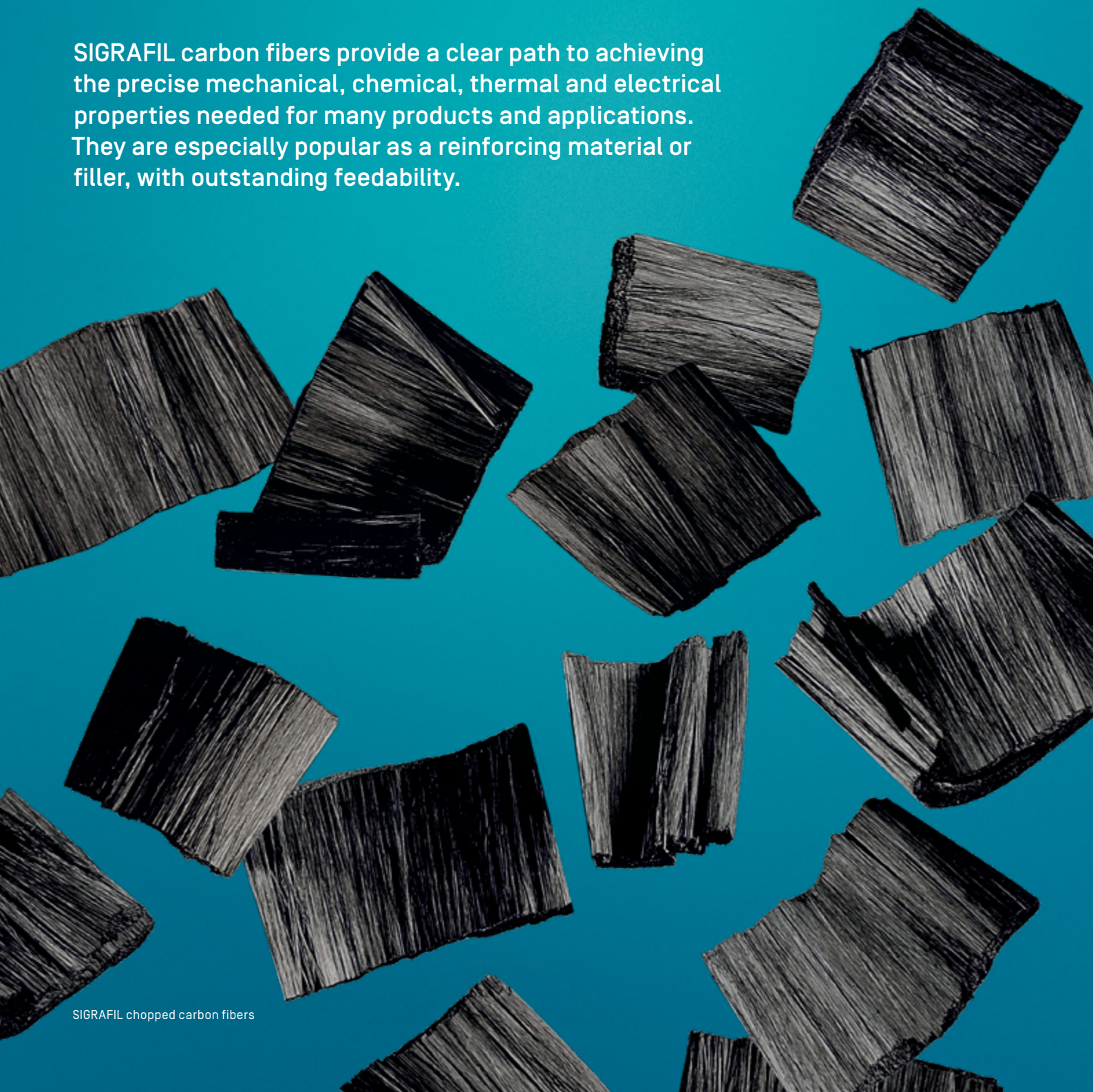
- Injection molding applications
- Fuel cell components

- Injection-molded parts

- SIGRAFIL® chopped carbon fibers
- SIGRAFIL® milled carbon fibers

Shortcut to success: our chopped carbon fibers

SIGRAFIL carbon fibers provide a clear path to achieving the precise mechanical, chemical, thermal and electrical properties needed for many products and applications. They are especially popular as a reinforcing material or filler, with outstanding feedability.



SIGRAFIL chopped carbon fibers

SIGRAFIL® precision-chopped carbon fibers

SIGRAFIL chopped carbon fibers are created through precision cutting of our continuous carbon fiber tows. They are available with various sizings and in various cut lengths. Beyond their outstanding mechanical, thermal and chemical properties, they also stand out for good electrical conductivity and excellent feedability.

As a functional additive, they are primarily used in the manufacture of compounds for thermoplastic injection molding processes in all temperature ranges. In addition, they are ideally suited for turning non-conductive materials such as plastics, resin systems and special papers into conductive ones.

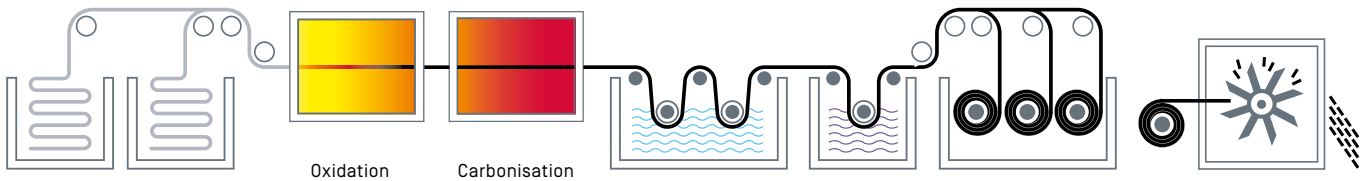
Chopped SIGRAFIL carbon fibers are used in printer and electronics components, bearing shells, fuel cell components, gearwheels, mechanical components and cement reinforcement. We offer individual solutions for a variety of requirements.

Typical customer products and processes:
- Thermoplastic compounds for injection molding
- Coating systems
- Anti-static and fire protection
- Adhesives
- Speciality papers
- Semi conductor processing equipment

Material benefits of SIGRAFIL chopped carbon fibers

- Excellent mechanical properties
- Low density
- Low thermal expansion
- Good electrical conductivity
- Corrosion resistant
- Excellent feedability

Manufacturing process of our SIGRAFIL® chopped carbon fibers



The best carbon fiber for each application

Our carbon fibers are available coated with various sizings and in different staple lengths to ensure consistently optimum fiber dispersion whatever the application, e.g. for thermoplastics, thermosets or aqueous processes.

For the production of compounds, we supply carbon fibers with special sizings. These are perfectly matched to the processing temperatures and bonding characteristics of the different thermoplastics. With our different SIGRAFIL materials, you can choose the specific carbon fiber property that you need.

Whether you are using carbon fibers as a reinforcing material or a filler, their properties can be transferred to your compounds and composites and ultimately to the end products. This opens up many different possibilities for you.

Nomenclature

SIGRAFIL C C6-4.0/240-T130

1 | 2 | 3 | 4 | 5 | 6

1	Brand name	SIGRAFIL
2	Material	C = carbon
3	Type	C = chopped, M = milled
4	Fiber length	Chopped fiber: in mm Milled fiber: in µm
5	Mechanical properties	Tensile strength / tensile modulus [GPa]
6	Sizing	T190 = aromatic polymer, E100 = epoxy, G100 = glycerin, T130 = polyurethane, UN = unsized

Material data of our SIGRAFIL® chopped carbon fibers

Typical properties	Units	C C6-4.0/240-T130	C C6-4.0/240-T190	C C6-4.0/240-E100	C C6-4.0/240-G100
Density	g/cm³	1.80	1.80	1.80	1.80
Fiber length chopped	mm/in	6/0.24	6/0.24	6/0.24	6/0.24
Filament diameter	µm	7	7	7	7
Tensile strength	GPa/ksi	4.0/580	4.0/580	4.0/580	4.0/580
Tensile modulus	GPa/Msi	240/35	240/35	240/35	240/35
Elongation at break	%	1.7	1.7	1.7	1.7
Single filament resistivity	µΩm/ µΩin	15/590	15/590	15/590	15/590
Bulk density	g/l	390	360		
Sizing type		polyurethane	aromatic polymer	epoxy	glycerin
Sizings mass content	%	2.7	1	3	4
Compatible with		PC, PA, POM, ABS, PBT	PEEK, PEI, PA, polyimides	epoxy, polyester	water based systems

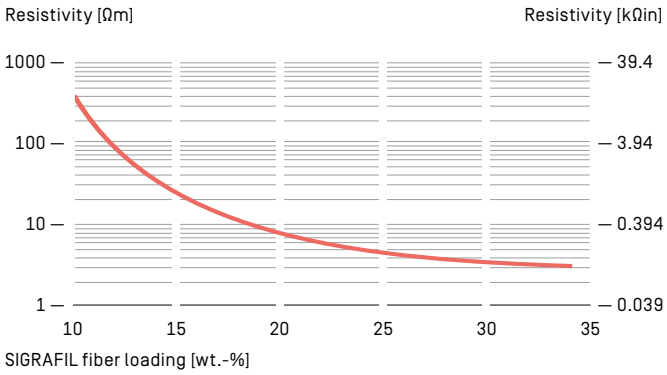
For E100 and G100 products other fiber lengths are available on request.

Relative properties of chopped carbon fibers in Engineering Thermoplastics

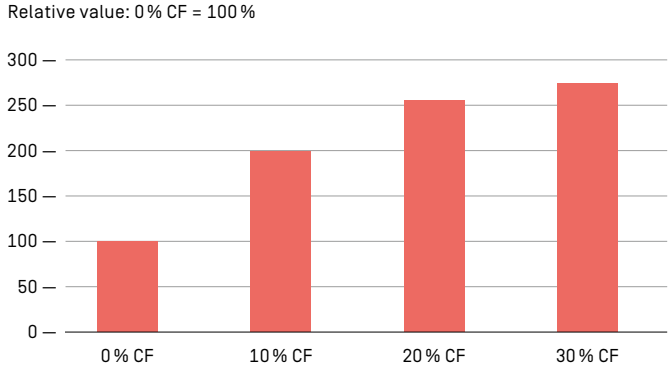
In the production of compounds, chopped carbon fibers are traditionally used as a filler material. By varying fiber loading, it is possible to control how strongly a particular carbon fiber property is expressed in the compound.

With higher fiber loading, there is a corresponding decrease in electrical resistivity and hence an increase in conductivity. Higher conductivity also results in better electromagnetic shielding. Similar behavior can be seen in the mechanical properties of our carbon fibers. With higher filler loading in the compound, stiffness and strength are increased, although the rise in stiffness is far greater. This is illustrated using data for polycarbonate compounds.

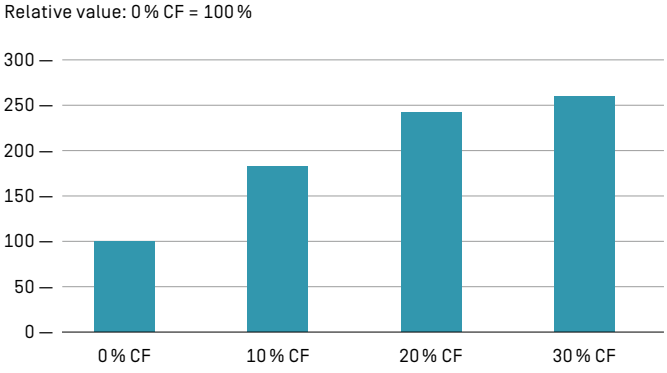
Conductivity



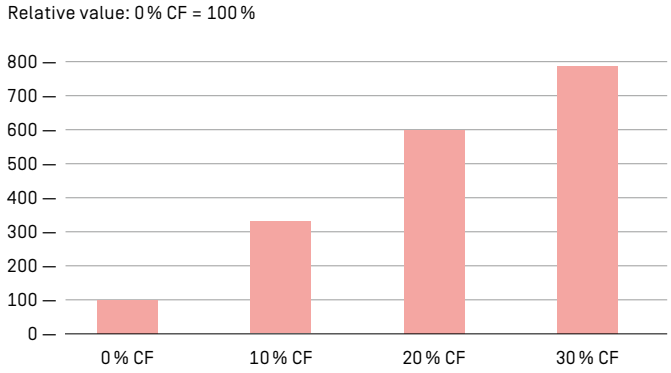
Relative tensile strength



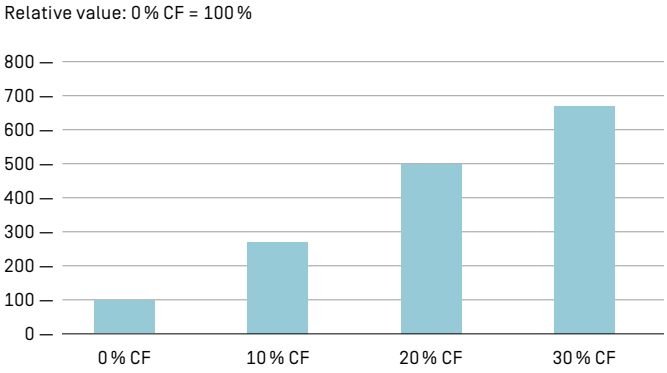
Relative flexural strength



Relative tensile modulus



Relative flexural modulus



Ideal for mixing processes: our milled carbon fibers

SIGRAFIL milled carbon fibers are suited for an entire range of applications. They are particularly ideal for all manners of mixing processes and shine in situations where the mechanical properties and electrical conductivity of a material system are to be enhanced.

SIGRAFIL milled carbon fibers

SIGRAFIL®
milled carbon fibers

We produce our SIGRAFIL milled carbon fibers from high-quality continuous carbon fiber tows from our own production lines. The fibers are unsized and they deliver the strong dispersion performance needed to achieve outstanding mix and processing characteristics. Beyond this, they feature excellent mechanical properties and good electrical conductivity.

Our milled carbon fibers are intended for use in a wide range of mixing processes. They are also ideal for the production of thermoplastic compounds. Other typical applications include floorings, adhesives and coatings. We offer individual solutions for a variety of requirements.

Material benefits at a glance

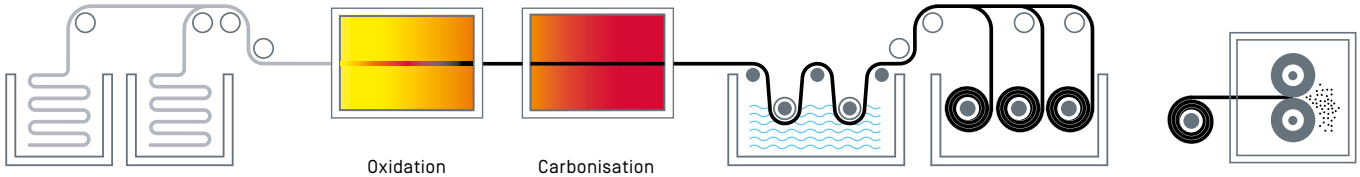
- Excellent mechanical properties
- Low density
- Low thermal expansion
- Good electrical conductivity
- Corrosion resistant
- Good dispersibility
- Controlled length distribution

Typical applications

SIGRAFIL milled carbon fibers can be used for the following customer products and processes:

- **Thermoplastic compounds**
- **Anti-static coating systems**
- **Friction materials**
- **Wear-resistant coatings**
- **Adhesives**
- **Floorings**

Manufacturing process of our SIGRAFIL® milled carbon fibers



Material data of our SIGRAFIL® milled carbon fibers

Typical properties	Units	C M80-3.0/200-UN	C M150-3.0/200-UN	C M80-4.0/240-UN	C M150-4.0/240-UN
Fiber density	g/cm³	1.80	1.80	1.80	1.80
Mean fiber length	µm	80	150	80	150
Filament diameter	µm	7	7	7	7
Tensile strength	GPa/ksi	3.0/435	3.0/435	4.0/580	4.0/580
Tensile modulus	GPa/Msi	200/29	200/29	240/35	240/35
Elongation at break	%	1.5	1.5	1.7	1.7
Single filament resistivity	µΩm/µΩin	22/870	22/870	15/590	15/590
Bulk density	g/l	380	250	380	250
Sizing type		unsized	unsized	unsized	unsized

Successful together

Which applications benefit most from our materials? Where can our products help optimize production processes? How can they help our customers achieve the results they desire? These are the questions we pursue daily.

We strive to provide our customers with more than just world-class short carbon fibers. What really matters is applying our deep pool of expertise to finding intelligent solutions that bring our customers lasting success – from material and process consulting to joint development of comprehensive customer-specific product solutions.

The three pillars for perfect customer solutions

Our many years of experience have taught us that three factors matter most in helping our customers achieve lasting success:

1 | Individual consultation on the right product
Every application is ultimately based on individual needs. Our comprehensive expertise in materials and machining processes, supplemented by our application-oriented database of products, lets us find the best solution for the specific problem, including a matrix approach to sizing that ensures the right fit.

2 | Uniformly high product quality
To ensure uniform high quality and performance characteristics in our short carbon fibers, we start exclusively with high-quality SIGRAFIL continuous carbon fiber tows produced completely in our own factories.

3 | Quick and knowledgeable technical support
Whenever our customers have questions – process, material performance, standards conformation or otherwise – we're there to help. Our experts have a deep pool of first-hand expertise to provide quick, uncomplicated and solution-oriented answers.

Smart Solutions

Be it materials, components or production processes, we put our customers first. With our in-depth material, engineering, and application know-how, we develop customized, reliable and high-quality solutions for our customers.

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

Mobility

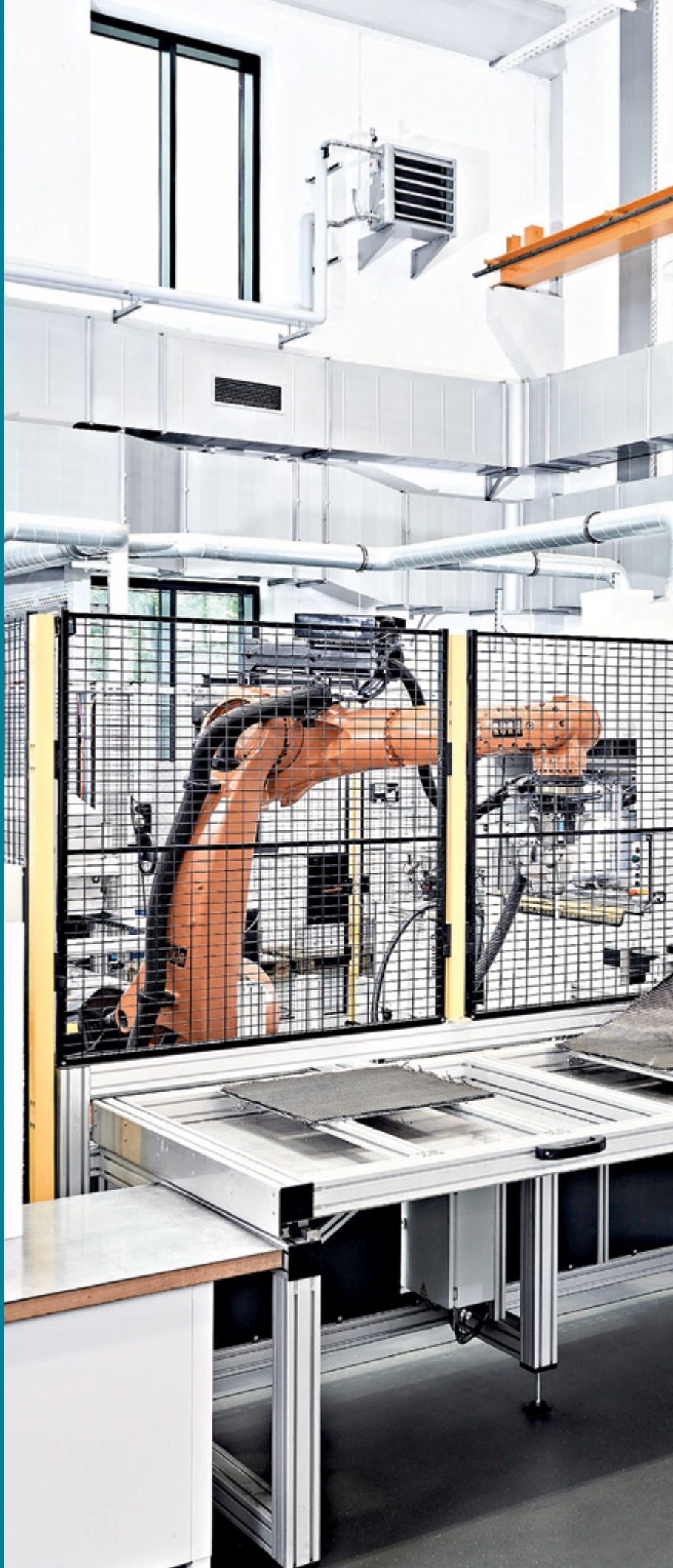
- Lightweight components and structural parts based on fiber-reinforced composites for automotive and aerospace manufacture
- Graphite anode material for lithium-ion batteries in electric vehicles
- Carbon-ceramic brake disks for sports cars and luxury sedans

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



SGL Carbon

We are a global leader in the development and manufacture of carbon-based solutions. Our materials and products made from specialty graphite, carbon fibers and composites serve many industries that are shaping the trends of the future: climate friendly mobility, semiconductor technology, LED, solar and wind energy, and the manufacture of lithium-ion batteries.

We are driven to grow with products and technologies that benefit society and reduce environmental and climate impacts.

Together with our customers, we develop intelligent and sustainable solutions that contribute to a smarter world.

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