SIGRASIC®
Carbon fiber-reinforced silicon carbide components

At a glance
SIGRASIC products derive their extraordinary properties from carbon fiber-reinforced silicon carbide (C/SiC) – a composite material that combines carbon fibers within a ceramic matrix to maximize the properties of both materials.

- Hard and ductile instead of being brittle
- High resistance to most corrosive and abrasive media
- Near net shape processing by in situ joining
- Adjustable properties to meet specific customer requirements
- High thermal-mechanical fatigue and high thermal shock resistance
- High heat resistance – up to 1200 °C
- Technology established within automotive serial production of brake disks

Application examples for our C/SiC

↑ NASA sensor carrier; designed for low weight, high precision and high stiffness
↑ Pump impeller for highly corrosive and abrasive media
↑ (High performance) clutch disk mass produced for cars/vehicles with excellent wear and strength properties
↑ Ballistic protection with complex shaped designs and high hardness

Manufacturing route
C/SiC is manufactured by infiltrating a carbon fiber-reinforced carbon body with silicon. Due to near net shape processing, complex machining can be performed cost-effectively early in the process. Final ceramic grinding can be used locally when tight tolerances are required. By suitable adjustment of the material and process parameters, the product characteristics can be matched to the intended use of the SIGRASIC component.
### Material data and microstructure of the different SIGRASIC® material types

<table>
<thead>
<tr>
<th>Typical properties</th>
<th>Units</th>
<th>Milled fibers [MF]</th>
<th>Short fibers [SF]</th>
<th>Long fibers [LF]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>2.7 – 3.0</td>
<td>2.1 – 3.0</td>
<td>1.8 – 2.2</td>
</tr>
<tr>
<td>Bending strength</td>
<td>MPa</td>
<td>130 – 350</td>
<td>60 – 90</td>
<td>150 – 230</td>
</tr>
<tr>
<td>Young’s modulus</td>
<td>GPa</td>
<td>150 – 330</td>
<td>30 – 60</td>
<td>50 – 80</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
<td>0.01 – 0.05</td>
<td>0.3 – 0.5</td>
<td>0.4 – 0.6</td>
</tr>
<tr>
<td>Thermal conductivity (20 °C)</td>
<td>W/(mK)</td>
<td>110 – 160</td>
<td>20 – 60</td>
<td>13 – 20</td>
</tr>
<tr>
<td>Thermal expansion (20 – 200 °C)</td>
<td>µm/(mK)</td>
<td>2.9 – 3.5</td>
<td>1.8 – 2.3</td>
<td>0.3 – 0.5</td>
</tr>
<tr>
<td>Temperature resistance*</td>
<td>°C</td>
<td>1400</td>
<td>1400</td>
<td>1400</td>
</tr>
</tbody>
</table>

* in non-oxidizing environments

- Technical properties are customizable for individual purposes
- Base materials can be designed with the relevant content and type of carbon fibers

#### Unique bending behavior and non-brittleness – uncommon properties for monolithic ceramic materials with pseudo-ductility

**Relative bending strength versus temperature**

![Graph showing relative bending strength versus temperature](image)

**SIGRASIC SF type (C/SiC)**

↑ Due to its unique material structure, our C/SiC is able to withstand severe multi-hit without breaking

↑ C/SiC is highly suitable for applications with extreme thermal shock requirements

---

Central Innovation | SGL CARBON GmbH
Werner-von-Siemens-Strasse 18 | 86405 Meitingen/Germany
Phone +49 8271 83 3523
sigrasic@sglcarbon.com
www.sigrasic.com | www.sglcarbon.com

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”.

TDS CSiC.01
07 2020/0.2NÄ Printed in Germany
registered trademarks of SGL Carbon SE