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 material properties.

- Hard and ductile instead of being brittle
- High resistance against 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
- Clutch disk for high-performance serial cars with excellent wear and strength properties
- Ballistic protection with complex shaped designs and high hardness

Manufacturing route
C/SiC is manufactured by infiltrating 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 of SIGRASIC® and microstructure of different C/SiC base materials

<table>
<thead>
<tr>
<th>Typical properties</th>
<th>Units</th>
<th>Felt</th>
<th>Short fibers</th>
<th>Woven fabrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>g/cm³</td>
<td>2.7 – 3.0</td>
<td>2.1 – 2.6</td>
<td>1.8 – 2.2</td>
</tr>
<tr>
<td>Bending strength</td>
<td>MPa</td>
<td>130 – 350</td>
<td>50 – 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-oxidating environments

- Technical properties and adjustability of base materials 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 a ceramic material

Relative bending strength versus temperature

† 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

Matrix-dominated

Fiber-dominated

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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.”