

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

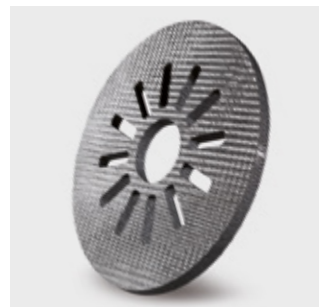
Application examples for our C/SiC



↑ 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

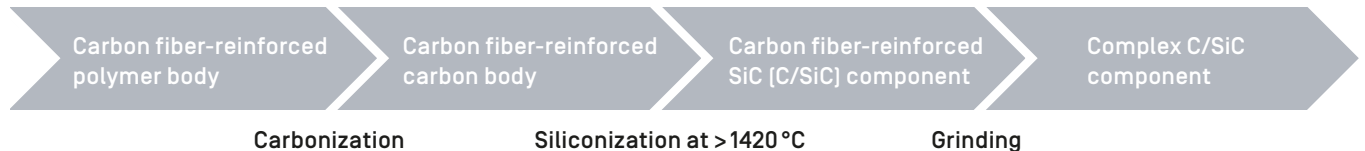


↑ Ballistic protection with complex shaped designs and high hardness

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.

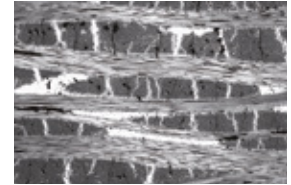
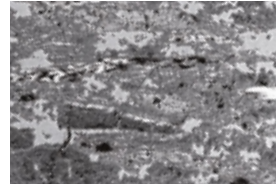


Material data and microstructure of the different SIGRASIC® material types

Typical properties	Units	Milled fibers (MF)	Short fibers (SF)	Long fibers (LF)
Density	g/cm ³	2.7 – 3.0	2.1 – 3.0	1.8 – 2.2
Bending strength	MPa	130 – 350	50 – 90	150 – 230
Young's modulus	GPa	150 – 330	30 – 60	50 – 80
Elongation at break	%	0.01 – 0.05	0.3 – 0.5	0.4 – 0.6
Thermal conductivity (20 °C)	W/(mK)	110 – 160	20 – 60	13 – 20
Thermal expansion (20 – 200 °C)	µm/(mK)	2.9 – 3.5	1.8 – 2.3	0.3 – 0.5
Temperature resistance*	°C	1400	1400	1400

* 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

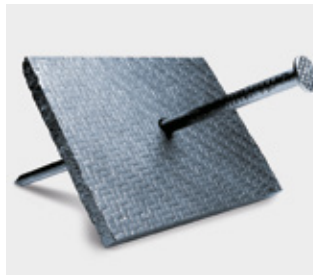
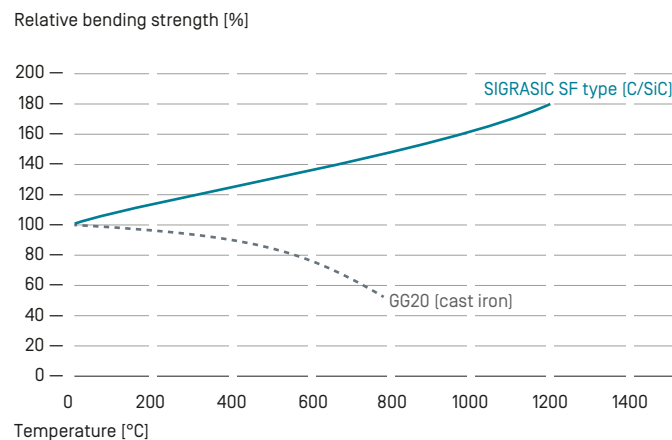


← Matrix-dominated

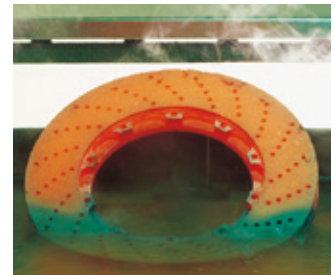
→ Fiber-dominated

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

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



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TDS CSiC.01

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