

**ROCAR® 3D:  
Ceramics in  
New Dimensions**

Additive Manufacturing  
with Silicon Carbide

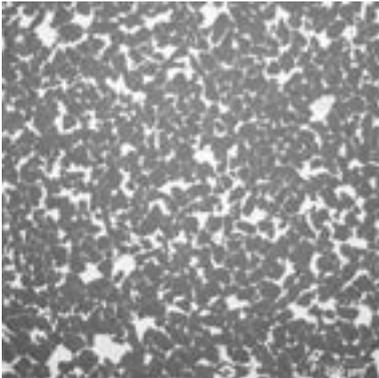


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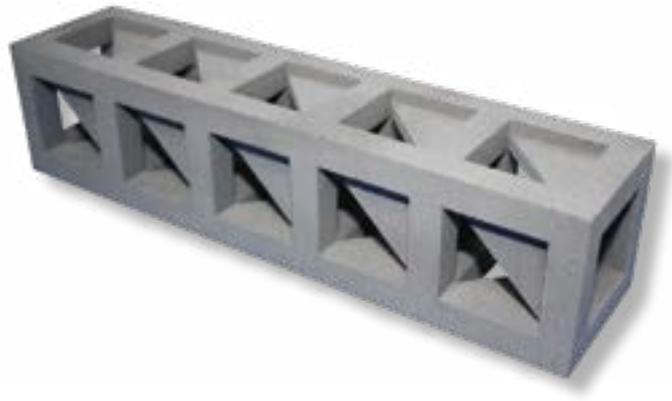
Silicon carbide 3D printing is a real game changer.

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# Additive manufacturing without compromise



**ROCAR 3D microstructure**  
Maximum homogeneity: the layer structure is no longer detectable in the microstructure.



Maximum flexibility, time and cost savings alongside optimal product quality: This 3D printing technology boasts numerous, often decisive advantages. At CeramTec, over 100 years of advanced ceramics expertise meets innovative spirit. We will guide you through the product development process, from the idea to the finished product.

## The advantages of our silicon carbide 3D printing technology:

- + Maximum design freedom
- + Flexibility: single-batch customization possible
- + Short delivery times
- + Competent service team
- + Maximum homogeneity, stability and product reliability



## Design freedom meets optimal material quality

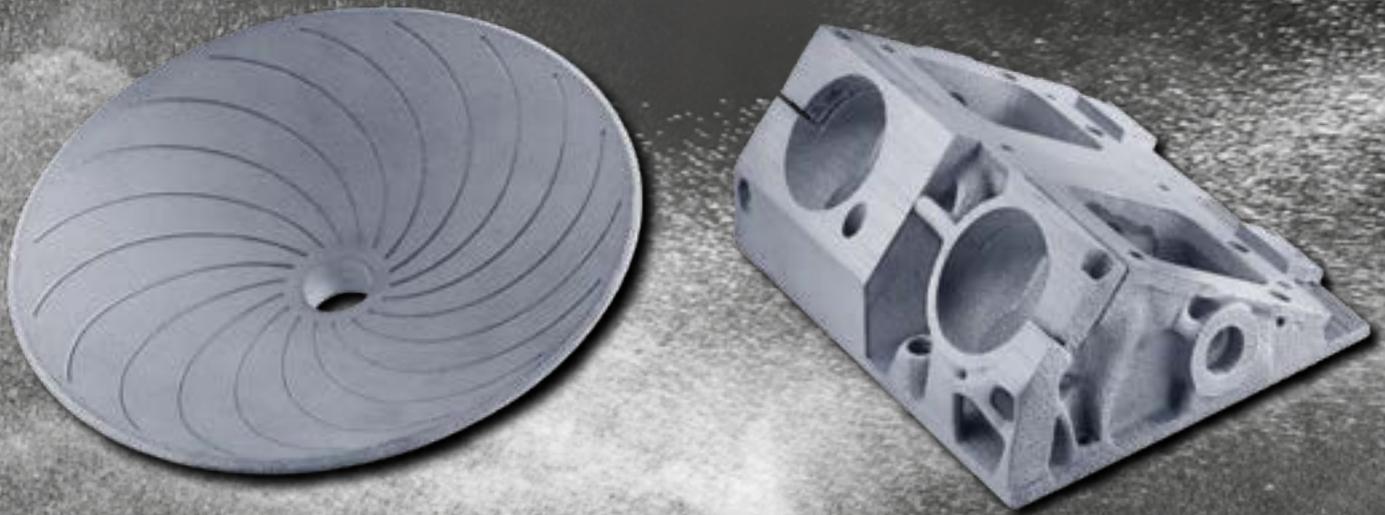
Experience complete design freedom with silicon carbide (SiSiC), a unique material in one of the most innovative manufacturing processes of our time: 3D printing.

Together with us you can create lightweight structural and functional parts, reduced in their design to include only absolutely necessary elements. Get your finished parts faster without time- and cost-intensive processing steps such as green machining, milling and mating and enhance further cost-saving potential through component optimization.

With material thicknesses from 2 mm to 35 mm and hole diameters from 2 mm, you have a diverse range of design options at your disposal.

### Unbeatable process advantages of 3D printing:

- + Print directly from CAD data
- + No tools required
- + Cavities and undercuts possible
- + Short production lead and tooling times
- + Maximum flexibility: make design changes with a mouse click
- + Digitalization of existing components possible
- + Simultaneous production of several components on one 3D printer



## Maximum flexibility and reliability – with all the advantages of 3D printing

CeramTec has succeeded in optimizing the material properties of additively manufactured SiSiC components to the point that their property values only differ from those of conventionally manufactured components by a few percentage points.

By using fine silicon carbide powder, it is possible to produce free shapes and first-rate surface qualities.

The very high hardness, combined with temperature and chemical resistance, means that the parts can also withstand the most demanding conditions. Low component weights, compared to metals, are not only due to the material's low specific density, but also due to reduced material usage thanks to the preceding component optimization.

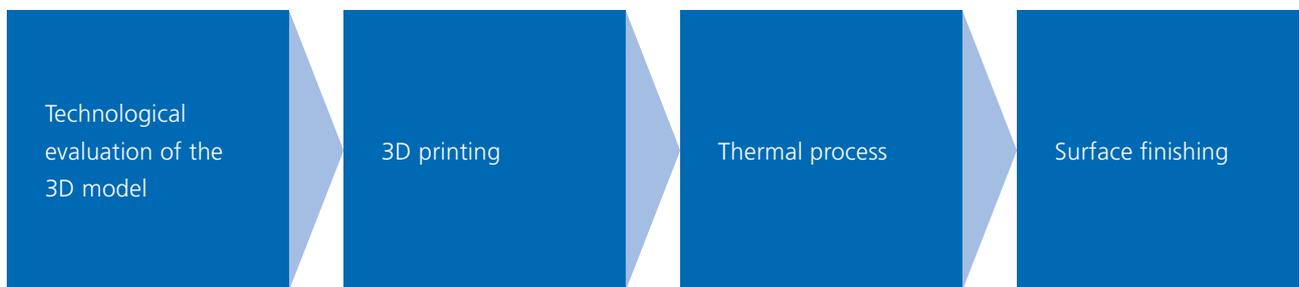
### The outstanding material properties of SiSiC:

- + Temperature resistance up to 1,350 °C
- + High hardness, stiffness and flexural strength
- + Lower density than metal
- + Resistant to acids and corrosion
- + Very abrasion-resistant
- + Thermal expansion near zero
- + High thermal conductivity
- + Resistant to oxidation
- + Tolerance in accordance with DIN ISO 2768-1 (coarse)
- + Erodible

# Our expertise for your success

CeramTec's additive manufacturing specialists draw on their comprehensive expertise in ceramics to support you in the implementation of your projects. From the evaluation of data to the optimization of production – from single-batch customization to small-batch production.

## Our service team ensures optimal results



For developers **“**  
who think outside  
the box.

**”**



# Material properties

PROPERTY	TEST METHOD, PARAMETERS AND STANDARD	UNIT	VALUE	
<b>GENERAL PROPERTIES OF SILICON CARBIDE (ROCAR® 3D)</b>				
Main component percentage		%	+/-	70–75 Vol% SiC
Minor component percentage		%	+/-	25–30 Vol% Si
Density	Archimedes, DIN EN 623-2	g/cm <sup>3</sup>	≥	2.95
Achievable average roughness R <sub>a</sub>	sand blasted	µm	≤	25
<b>MECHANICAL PROPERTIES</b>				
Flexural strength <sup>1)</sup>	4-point flexural test, 20 °C, DIN EN 843-1	MPa	≥	220 <sup>1)</sup>
Weibull modulus m	4-point flexural test, 20 °C, DIN EN 843-5	[ - ]	≥	10
Fracture toughness K <sub>IC</sub>	SEVNB, DIN EN 14425-5	MPa(m) <sup>1/2</sup>	≥	2.0
Young's modulus	Ultrasonic, DIN EN 843-2	GPa	+/-	340
Poisson number	Ultrasonic, DIN EN 843-2	[ - ]	+/-	0.18
Hardness	Vickers, similar to DIN EN 843-4	GPa	≥	Two-phase material <sup>2)</sup>
<b>THERMAL PROPERTIES</b>				
Thermal expansion coefficient α	20–100°C, DIN EN 821-2	10 <sup>-6</sup> K <sup>-1</sup>	+/-	4.0
Thermal conductivity λ	20–100°C, Xe-flash, DIN EN 821-2	W/(m·K)	+/-	160

Notes:

<sup>1)</sup> along the Z-axis 200 MPa

<sup>2)</sup> HV 0.2 1200 (Si) / 2700 (SiC)

All herein aforementioned measured values were determined for test samples and are applicable as standard values. The values were determined on the basis of national or international standards and if these were not available, on the basis of CeramTec internal specifications standards. Statements regarding the suitability of products for certain types of applications are based on knowledge of typical requirements that are often placed on CeramTec products in generic applications and must not be transferred to specific applications. The same applies to the indicated values. The information contained herein does not constitute a guarantee for certain properties. CeramTec and its affiliates do not assume any responsibility for the correctness of such information nor for damages consequent to its use. Please note that all product, product specifications and data detailed in this media are subject to changes.

CeramTec GmbH  
CeramTec-Platz 1-9  
73207 Plochingen, Germany

Phone +49.7153.611-0

Fax +49.7153.25421

E-Mail [myceramtec@ceramtec.de](mailto:myceramtec@ceramtec.de)

