

# IntrinSiC®: Just Printed – Just Mohs 9,6

IntrinSiC® is the superior innovation for the production of large, complex, monolithic constructional elements made from silicon-infiltrated, reaction-bonded silicon carbide (RBSiC). Based on this innovation it became feasible for the first time to provide large parts with a certain complexity efficiently by 3D printing accompanied by a diamond-like hardness. A highly innovative new product which allows for the efficient manufacture of high quality precision parts.

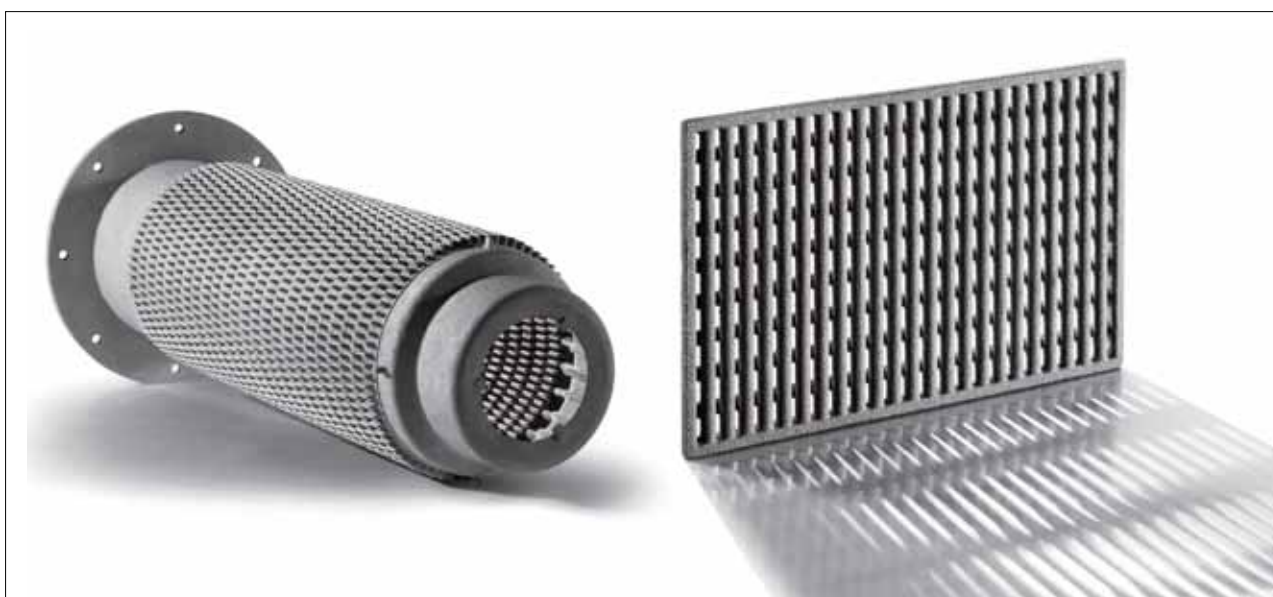


Fig. 1  
Ceramic components made from reaction-bonded SiC by IntrinSiC®-technology

## **IntrinSiC® – a process innovation at SCHUNK Ingenieurkeramik GmbH**

IntrinSiC® is a new shaping method developed to complement long-established ceramic manufacturing methods such as slip casting, extrusion or ISO pressing.

The key aspect here is that the physical, chemical properties of an IntrinSiC® component differ only insignificantly from those of a component in the same material group

### **Keywords**

*3D printing, complex monolithic structures, reaction-bonded silicon carbide (RBSiC)*

produced in a conventional manufacturing process.

With this method, designers can now combine the known advantages of RBSiC ceramics with the design freedom an additive manufacturing process offers.

IntrinSiC® components are manufactured on the basis of powder bed technology. SiC particles are applied layer on layer and three-dimensionally cross-linked with a binder. In a pyrolysis process the binder is transformed into carbon and the component is impregnated with metallic silicon in a conventional siliconizing process.

The infiltrating silicon reacts with the carbon, resulting in the formation of secondary SiC and a reaction-bonded SiC. A gas tight material!

The whole process takes place without any shrinkage – i.e. particularly large and complex components can be produced. Com-

*SCHUNK Ingenieurkeramik GmbH  
47877 Willich-Münchheide  
Germany*

*[www.schunk-group.com](http://www.schunk-group.com)*

ponent volumes up to 1 m<sup>3</sup> can already be realized.

Moreover, it is possible to join a component that, for example, has been fabricated by means of casting or extrusion to an IntrinsicSiC component, and transform them into a monolithic component by means of reaction bonding firing.

The maximum possible component size is only limited by the size of the furnace used! Of course, after firing, the component can be hard-machined. The realizable surface finishes and tolerances are determined by the equipment used. Thanks to its zero pores, the material can be precision-machined down to the µm-range.

**From prototype to volume production**

IntrinsicSiC® combines excellent material properties of RBSiC with process-related advantages of the 3D printing, providing a new dimension of constructive design potentials – i.e. in the market segments of lithography, metrology and thermal process technology.

Even large and complex monolithic structures with undercuts and cavities are feasible to be formed in just one single manufacturing step. Besides, a high degree of surface finish can be achieved by grinding, polishing and lapping.

Upon customer request SCHUNK Ingenieurkeramik may moreover realize a reverse

Tab. 1 Properties of of RBSiC made by IntrinsicSiC®

Bulk density	[g/cm <sup>3</sup> ]	3,05
Apparent porosity	[vol.-%]	0
Modulus of rupture (4 point loading)	[MPa]	120
Modulus of elasticity	[GPa]	360
Vickers hardness		2800
Thermal expansion coefficient (RT – 400 °C)	[10 <sup>-6</sup> /K]	3,9
Thermal conductivity	[W/m·K]	120
Chemical composition	[mass-%]	SiC 85 Si 15

engineering of existing parts using tactile or non-tactile measuring methods (i.e. laser-scanning) for data evaluating and digitizing.

**IntrinsicSiC® combines various process- and material advantages**

*Process advantages of 3D printing:*

- Realizing of undercuts and/or cavities
- No time-consuming manufacturing from patterns and moulds (CAD-data means parts ready for manufacturing immediately)
- High degree of process-flexibility
- Design modification by the click of a mouse

- Fast production lead times
- No time-consuming retooling of moulds
- Digitizing from existing parts by Reverse Engineering.

*Material advantages of RBSiC:*

- High temperature resistance
- Low mass
- Low thermal expansion
- Very high stiffness, bending strength and hardness
- High degree of size accuracy
- Excellent corrosion- and oxidation resistance
- High thermal conductivity
- Direct polishable surfaces.

\* Intrinsic (from latin intrinsecus) originally means “internal” or “inwards”, in a later reinterpretation “coming from inside”. An intrinsic property is a property of a system or of a material itself or within – this perfectly defines the quality of IntrinsicSiC®.



## Your Media Partner

---

Advertising Manager  
Corinna Zepter, ☎ +49 (0) 7221-502-237  
E-mail: c.zepter@goeller-verlag.de

CERAMIC APPLICATIONS

Components for high performance