

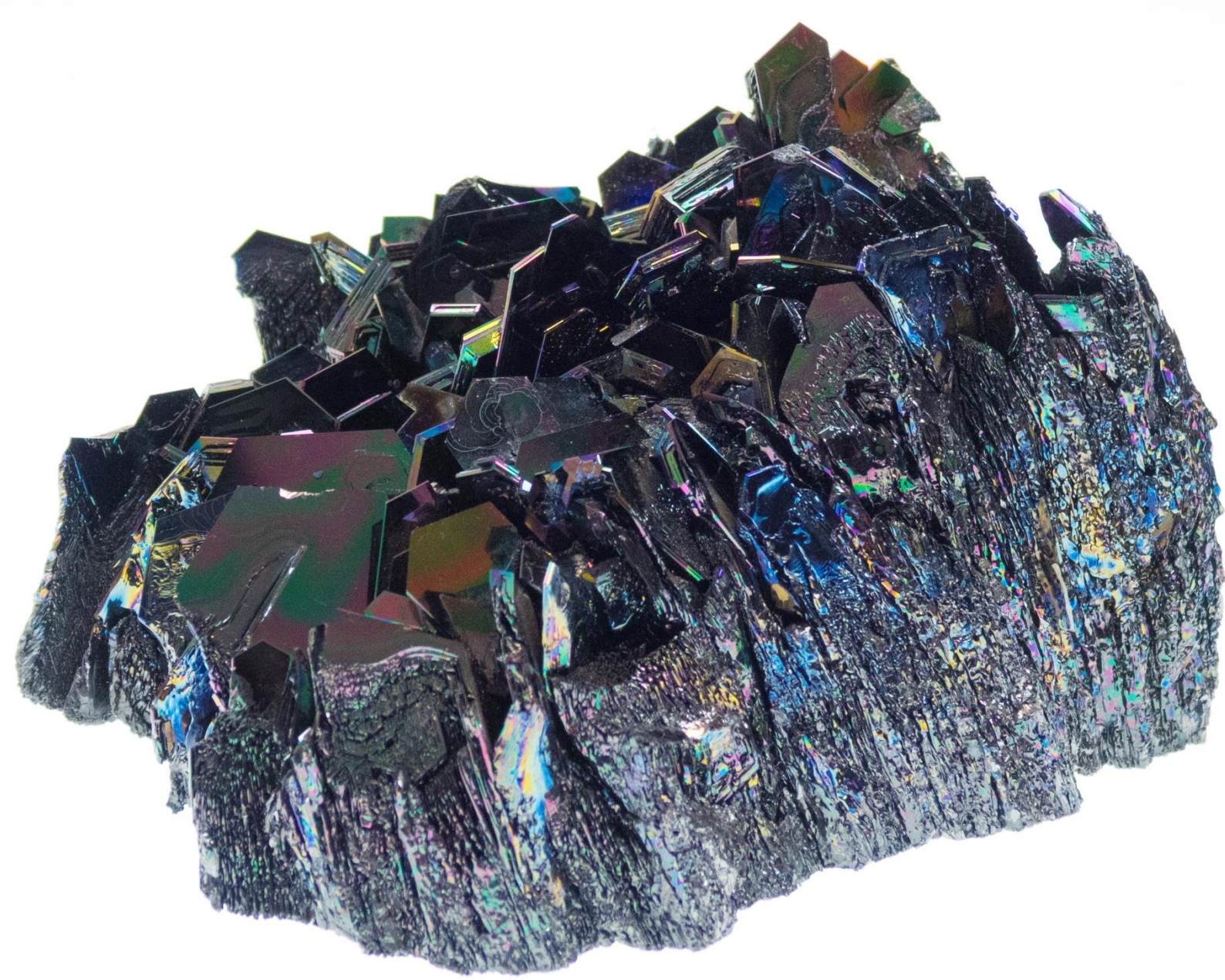
Silicon Carbide on the right spot

Abstract

Silicon Carbide is a material which belongs to the group of the technical ceramics. SiC exists in various forms, each with different properties. The production method greatly influences the final material properties. Special features are: incredible high stiffness, very low thermal expansion and low density. These unique properties makes SiC the material of choice for key parts in high precision applications.

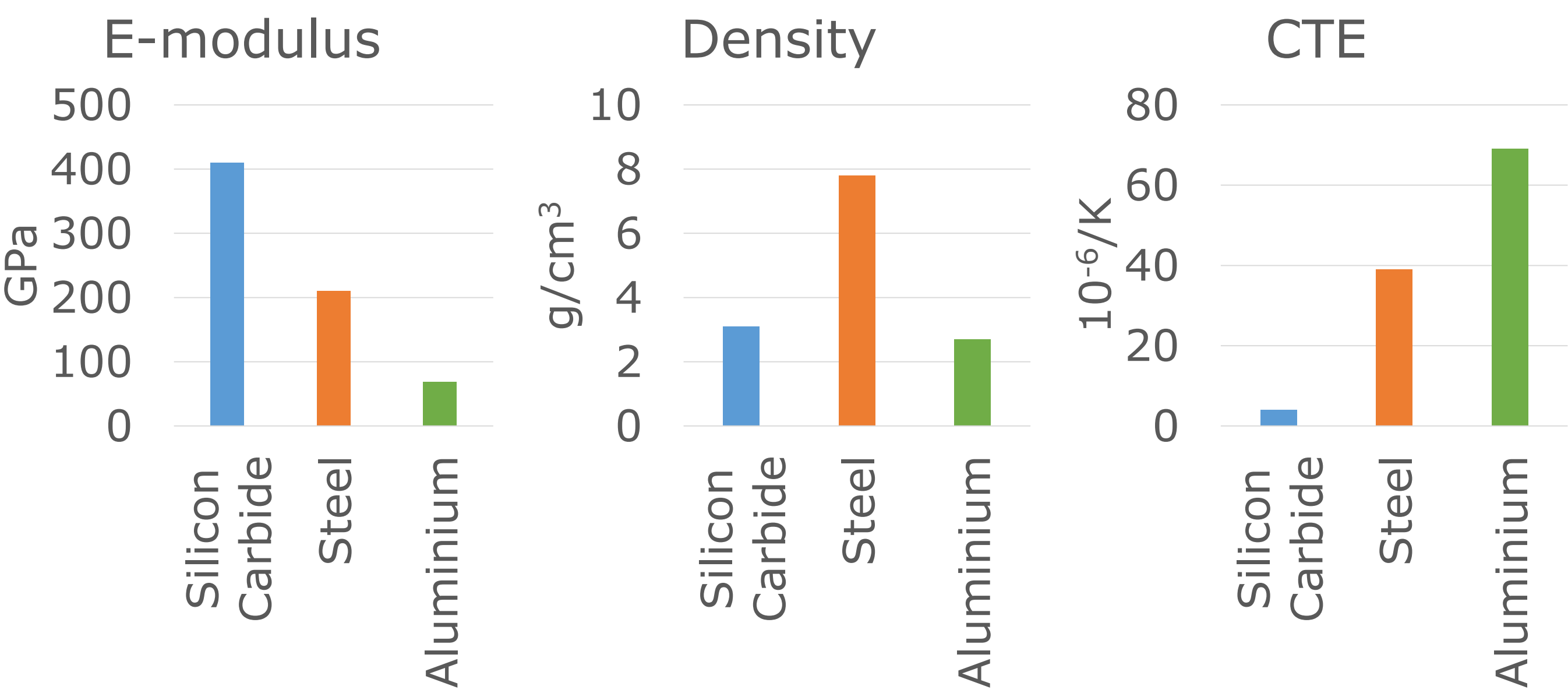
Silicon Carbide

Silicon Carbide is a compound of silicon and carbon with the chemical formula SiC. There are multiple ways of producing this material. A common method is pressing a SiC powder mixture combined with a binder to a “green” blank. To obtain the final material properties, the “green” blank is sintered in an inert atmosphere at temperatures in excess of 2000 °C.

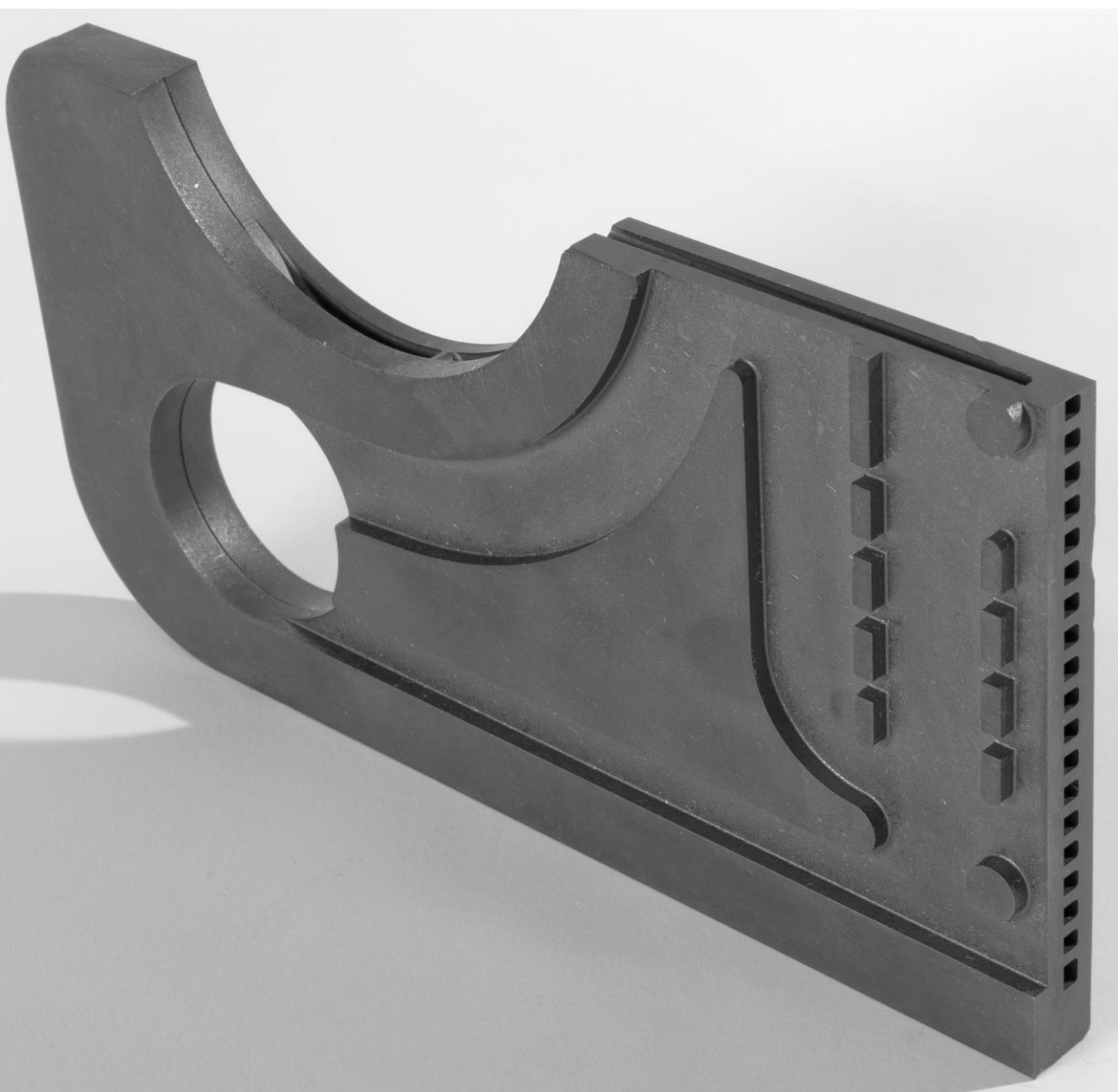


Material properties

The most important properties of SiC compared to other construction materials such as steel and aluminium are shown in the tables below.



As shown in the tables above: Silicon Carbide has an incredible high E-modulus and very low thermal expansion compared to steel and aluminium. This makes SiC the material of choice for key parts in high precision applications. Also the low density is an advantage for high speed positioning units. Due the good chemical resistance, silicon carbide can also be applied very well under extreme conditions.



Source: ESK



Source: Ceratec

Machining possibilities

The machining possibilities can be split in two groups: before and after sintering. This distinguishing can be made because the material properties are different. Before sintering, the blank is held together by the binder. This makes the part quite fragile but also makes rapid removal of material possible.

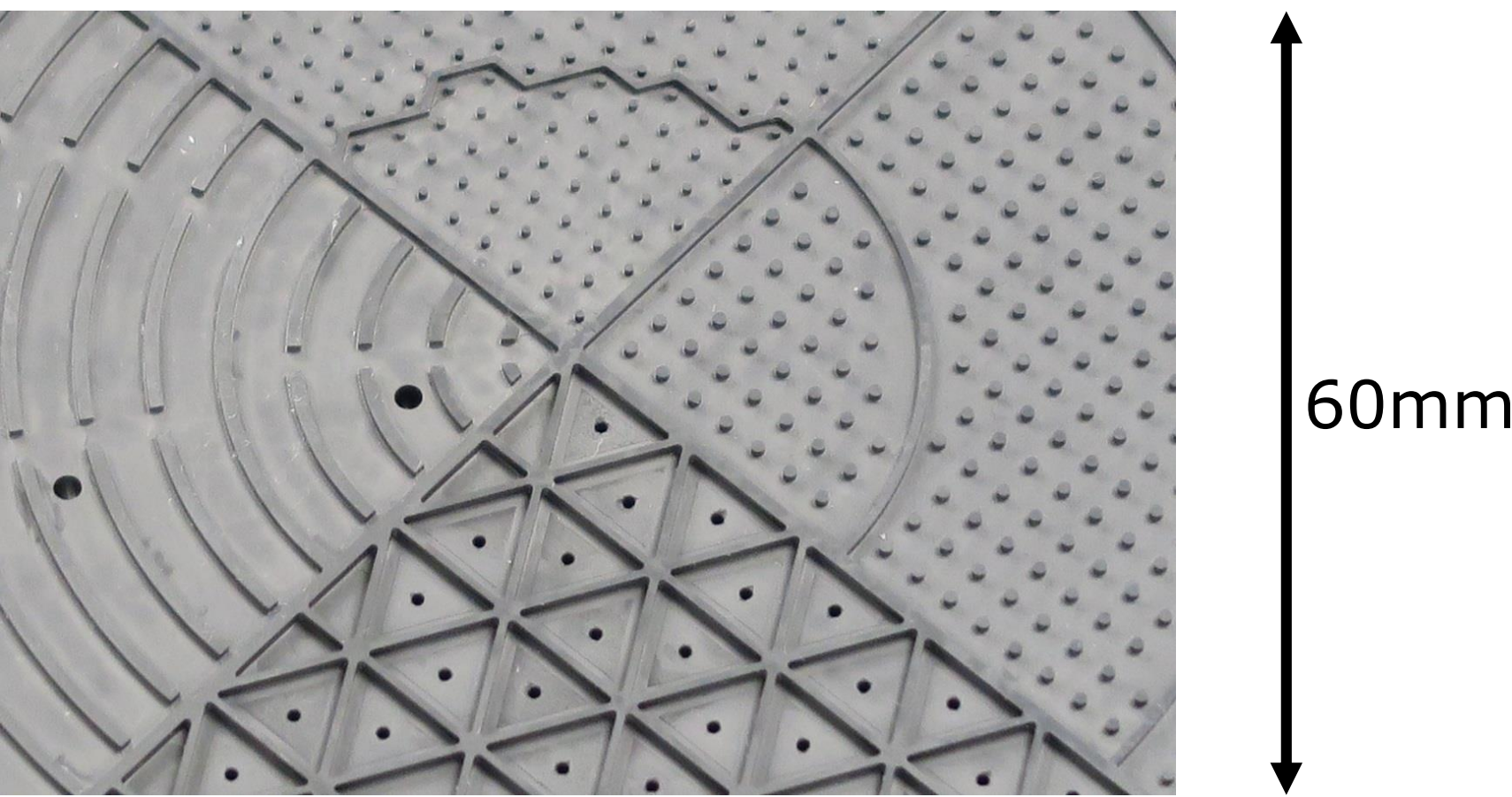
Machining possibilities before sintering are:

- Green machining on a mill or lathe: the “green” blank can be machined via traditional methods. The only difference is the use of specialised tools.
- Additive manufacturing: this “new” production method enables the production of complex shapes which are not possible via traditional production methods.
- Moulding: The powder and binder mixture can be pressed via special tooling in the desired shape.

After sintering, the material has its final material properties. The product shrinks during sintering which causes deviations in the shape. So for precision components rework is necessary. The shrinkage can be predicted very accurately, also in serial production.

Machining possibilities after sintering are:

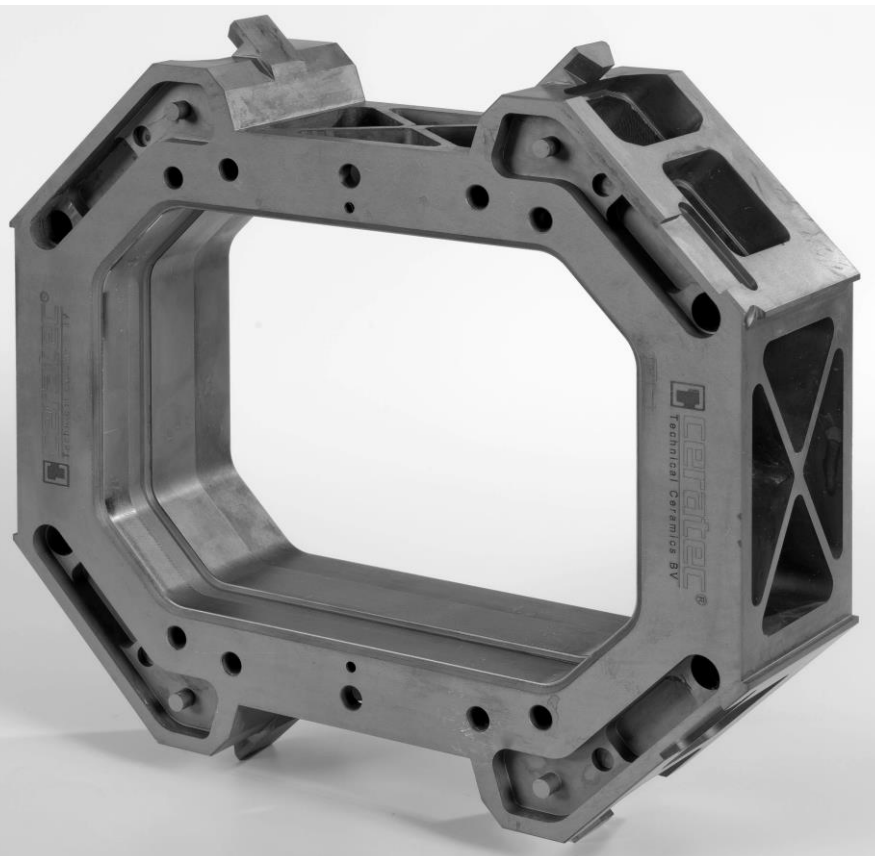
- Grinding: The only material harder than SiC is diamond. So diamond grinding tools are used to machine the parts to final spec.
- EDM (spark eroding): SiSiC is an electrical conducting variant of SiC. This material can be spark eroded due to this property.
- Laser: via laser cutting and ablation very intricate features can be made with outstanding precision.



Source: Ceratec

Your product advantage

The material is used in a wide variety of applications. A very useful combination of material properties for frame parts in high tech systems is the thermal stability combined with stiffness. This combination minimises thermal and mechanical drift. The combination of low density, high stiffness and low CTE match with silicon wafers makes it an ideal material for clamping Si wafers, Picometer precise metrology and other precision engineering challenges.



Source: Ceratec



Source: Haldenwanger