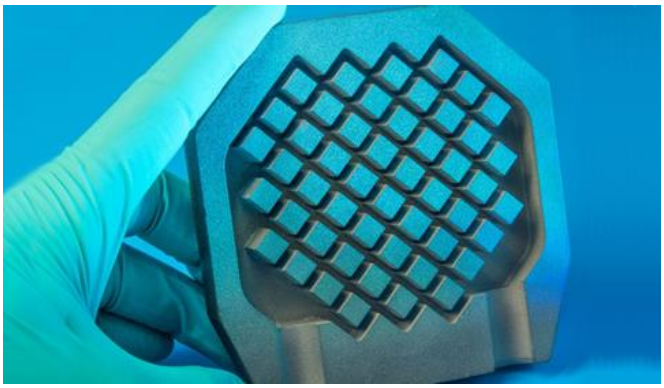
Silicon carbide-bonded diamond materials

Fraunhofer IKTS

Components with maximum thermal conductivity for thermal management

Material

Silicon carbide-bonded diamond materials can be produced in a wide range of geometries and dimensions without cost-intensive high-pressure processes. The diamond particles (up to approx. 60 % by volume) are chemically bound into the SiC matrix by a reaction bond. This gives the composite not only extreme thermal conductivity but also very high rigidity (modulus of elasticity up to 700 GPa) and wear resistance. By modifying the composition and microstructure, the properties can be varied over a wide range.

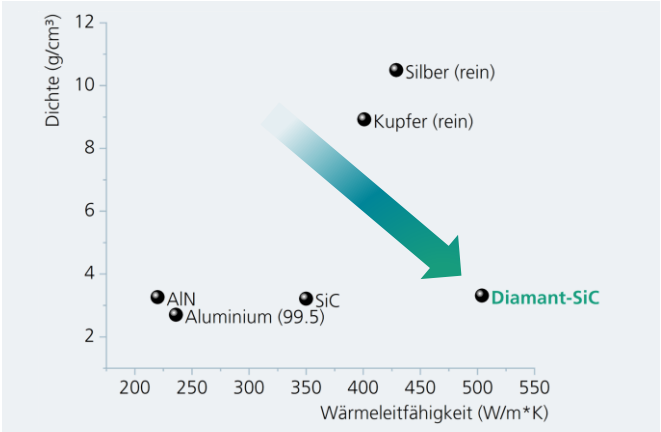


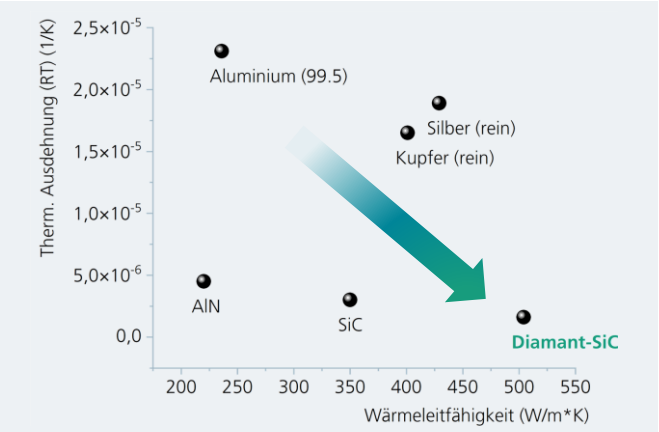
Cooling element made of SiC-bonded diamond material.

Thermal conductivity

Silicon carbide-bonded diamond materials have an extremely high thermal conductivity of up to 650 W/(mK). Silver, on the other hand, as the best thermal conductor made of metal, only achieves 430 W/(mK).

In addition, SiC-bonded diamond ceramics are characterized by their low thermal expansion coefficients and high corrosion resistance.





Thermal conductivity, thermal expansion and density of SiC-bonded diamond materials compared to other materials for thermal management.

Manufacturing costs

The manufacturing costs for simple geometries are similar to those of other commercial non-oxide ceramics.

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