

# Additively manufactured single- and multi-material ceramic components

**The qualification of high-performance ceramics for additive manufacturing results in components with previously unknown combinations of properties.**

High-performance ceramics have outstanding thermal, chemical, and mechanical properties and are superior to metallic and polymer materials in many applications. However, these materials are very difficult to machine due to their high hardness. AM technologies now also enable the realization of geometrically highly complex components.

High-performance ceramics are used where other materials fail. However, it is only by qualifying these materials for AM technologies that their outstanding material properties can be combined with high geometric functionality. A wide variety of AM technologies are used for this purpose, which are also used for AM of polymers, except that highly particle-filled materials are used and thermal processing is still necessary after the shaping process.

The functionality of components can be further enhanced by manufacturing AM components consisting of different materials. These multi-material components enable combinations of properties such as electrical or thermal conductivity and insulation, density and porosity, or different colors. This allows

a wide variety of application scenarios to be addressed in which highly robust components with integrated functionalities such as electric heaters or sensors, high aesthetics, or previously unheard-of combinations of properties are required.

At Fraunhofer IKTS, six different AM technologies are used to manufacture ceramic, hardmetals and glass AM components. Three of these AM technologies, as well as various manufacturing strategies, are also suitable for AM of multi-material components. One of these technologies, multi-material jetting (MMJ), was developed specifically for this purpose and has since been commercialized by the spin-off AMAREA Technology GmbH.

## Fraunhofer Institute for Ceramic Technologies and Systems IKTS

Lisa Gottlieb M. Sc.  
Tel. +49 351 255-37294  
[lisa.gottlieb@ikts.fraunhofer.de](mailto:lisa.gottlieb@ikts.fraunhofer.de)  
[www.ikts.fraunhofer.de](http://www.ikts.fraunhofer.de)

[exhibit overview](#)