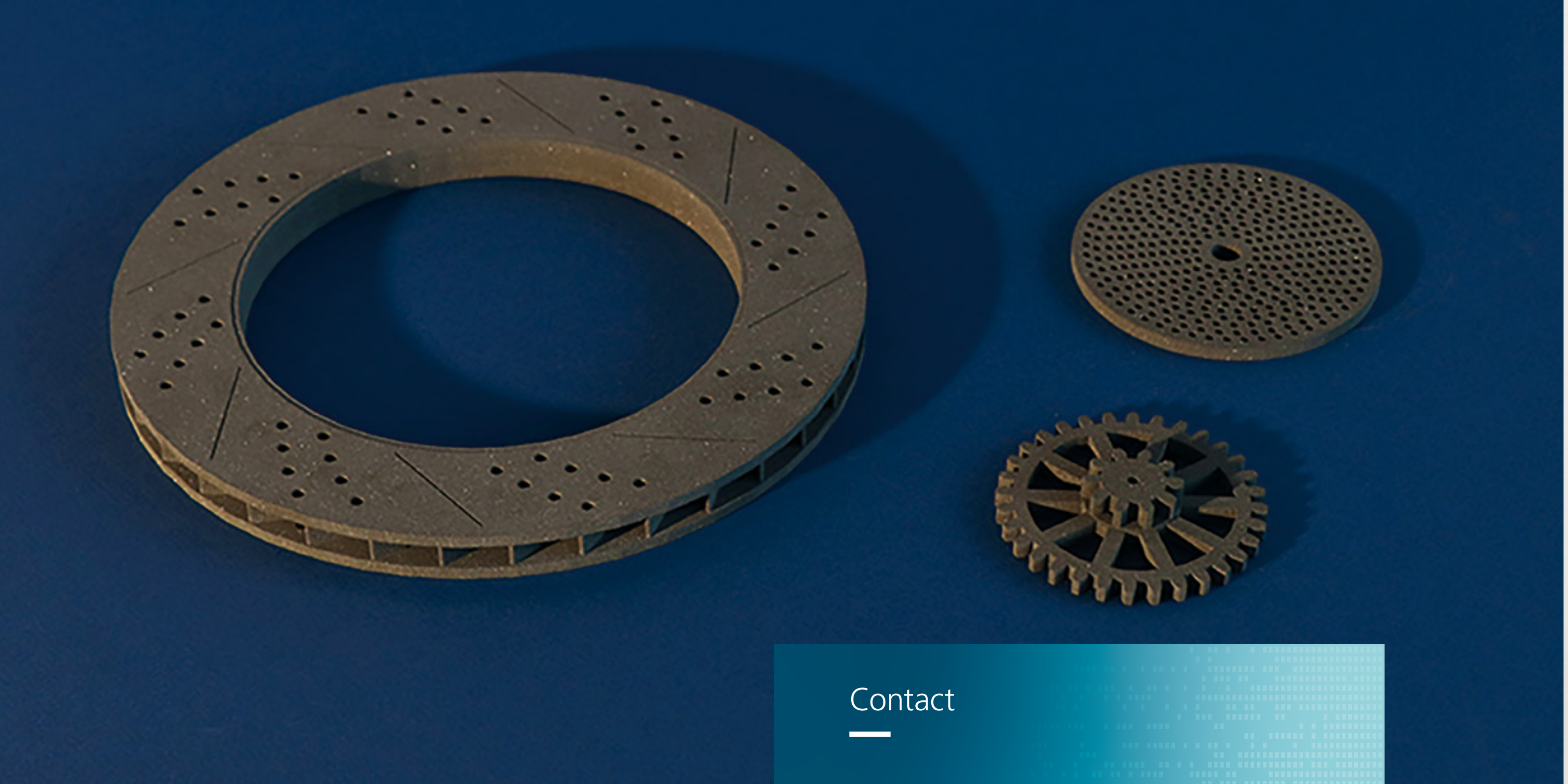


Service Offering

- **CAD Model** design and construction
- **Feasibility** and metallurgical studies
- **Fabrication** of complex and filigree prototypes and small-scale series
- **Extensive** material variety
- **Development** of starting materials (powder offsets, slurries, binder and ink systems)
- **Extensive** part characterisation
  – Part geometry and contour accuracy
  – Mechanical, thermal and mechanical-thermal properties
  – Micrographs
  – Computed tomography
  – Scanning electron microscope images

Contact

Joachim Vogt
Phone +49 921 78510 417
joachim.vogt@isc.fraunhofer.de

Waldemar Walschewski
Phone +49 921 78510 512
waldemar.walschewski@isc.fraunhofer.de

Fraunhofer-Center for High Temperature Materials and Design HTL
Gottlieb-Keim-Straße 62
95448 Bayreuth
www.htl.fraunhofer.de

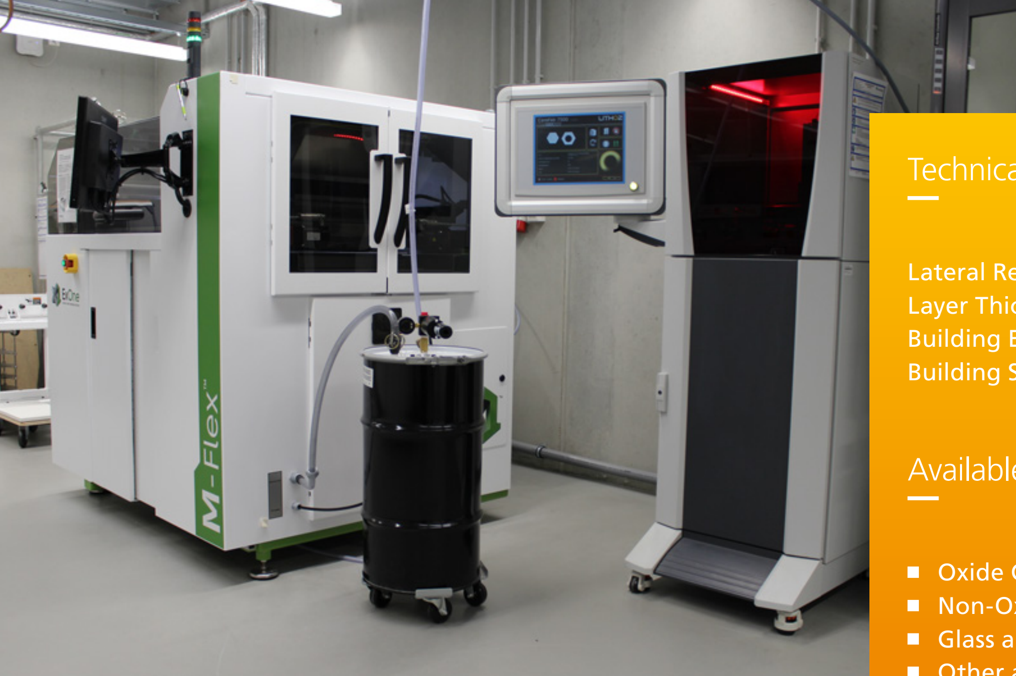
Fraunhofer-Center HTL is certified acc. to ISO 9001:2015

Fraunhofer ISC

Center for High Temperature Materials and Design HTL

Additive Manufacturing

High Temperatures – Efficient Solutions



Technical Data CeraFab 7500

Lateral Resolution: 40 µm (635 dpi)
Layer Thickness: 25 µm
Building Envelope (X,Y,Z): 76 x 43 x 150 mm
Building Speed: 1 - 3 mm per hour

Available Materials

- Oxide Ceramics (Al_2O_3, 3Y-ZrO_2, mullite, ...)
- Non-Oxide Ceramics (SiAlON)
- Glass and Glass Ceramics
- Other and Custom Materials on Request

Technical Data M-Flex

Lateral Resolution: 64 µm
Layer Thickness: 50 - 100 µm
Building Envelope (X,Y,Z): 400 x 250 x 250 mm
Building Speed: 3 - 12 mm per hour

Available Materials

- Alumina (optional infiltration with glass)
- Silicon Carbide (optional infiltration with Si)

Additive Manufacturing

Using modern techniques of Additive Manufacturing, Fraunhofer-Center HTL develops and fabricates customer-specific parts and prototypes. In doing so, the HTL does not only pursue the fast and cost-efficient fabrication of parts, but also the development of novel construction and design principles in the fabrication of ceramic, metal-ceramic and metal components.

In applying techniques of additive manufacturing, it is possible to create filigree and complex components integral with little effort. Hereby, subject to the printing technique, elaborate post-processing steps can be minimised or even eliminated completely. Furthermore, depending on the required space, multiple and also diverse parts can be fabricated simultaneously. Thus high expenses for moulds can be saved, and development cycles can be shortened.

For the purpose of additive manufacturing two different and complementary methods are available, which enable the fabrication of technical ceramics as well as porous ceramic and dense metal-ceramic or metal parts. Optionally, demonstrative parts consisting of polymer can be printed for testing purposes in advance.

Printing Techniques

Slurry-Based Fabrication

Components made of technical ceramics are produced layer by layer using bath-based photopolymerisation (VPP). In this process, a ceramic suspension that contains ceramic particles and a photo-sensitive binder is fused by radiation in the visible range via an exposure mask. The green parts generated this way are subsequently detached from the building platform, cleaned, debinded and sintered to the final technical ceramic component.

Binder Jetting

In binder jetting technology, components are printed layer-wise by selectively jetting a liquid organic binder into a powder bed. The printed parts are then cured in the oven and freed from unbounded powder. The unbounded powder is recycled and can be reused in further printing. The components following the printing and curing operations are porous. At a final heat treatment step, the components are debinded and densified by sintering or by metal melt infiltration. By combining the powder bed method and an inkjet print-head utilising various binder liquids together with various infiltration materials, it is possible to additively manufacture complex prototypes and small batches in an enormous range of metal-ceramic material combinations.