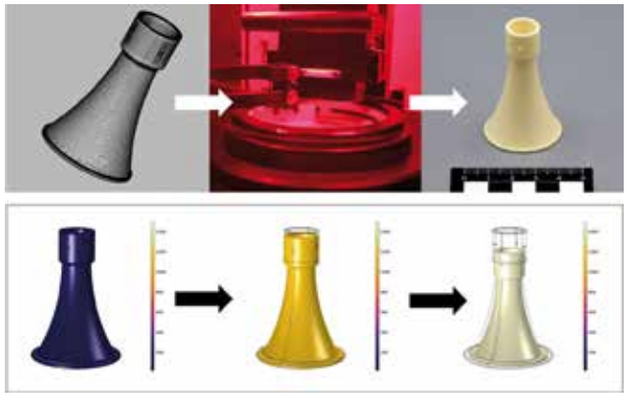

Fraunhofer-Center HTL
is certified acc. to ISO 9001:2015

Services

- **Identification** of suitable materials (ceramics, metals and metal-ceramic composites) and manufacturing processes for customer-specific issues
- **Construction and design** of components using FE methods including topology optimisation
- **Development and optimisation** of raw materials (suspensions, powders, inks etc.) as well as binder systems
- **Implementation and optimisation** of powder metallurgical heat treatment processes in various furnace atmospheres
- **Production** of prototypes and small series
- **Feasibility studies** along the process chain
- **Development** of novel AM processes including device engineering
- **Component characterisation**
  - Part geometry and failure analysis
  - Thermal and mechanical properties
  - Microstructure analysis

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Center for High Temperature Materials and Design HTL

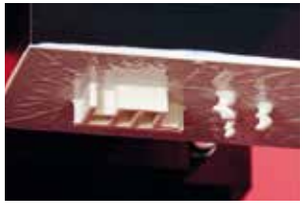
Additive Manufacturing and Digital Production

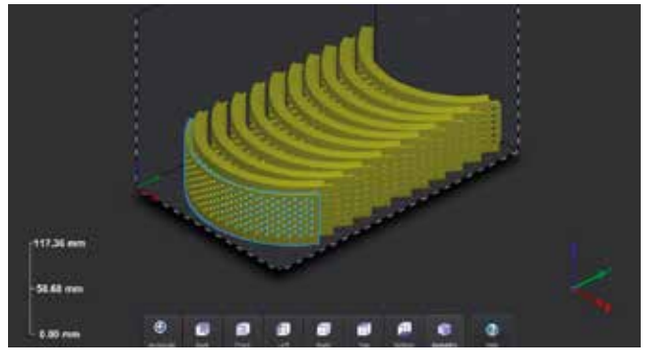
Additive Manufacturing and Digital Production

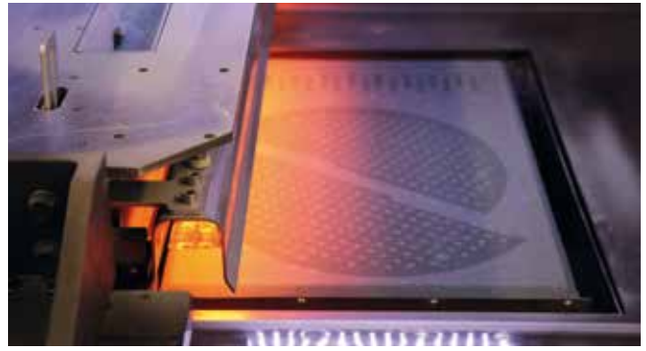
At the HTL, potent two-stage additive manufacturing processes are available, which enable the production of components made of ceramics as well as metals, glasses and metal-ceramic composites in porous or dense form. The heat treatment that follows the additive shaping process is also carried out and optimised at the HTL. Using additive manufacturing allows for:

- **Producing** load-oriented, filigree and complex components, e.g. for lightweight construction
- **Integration** of several components in one part and thus saving assembly costs
- **Production** of highly individualised products economically (e.g. for medical technology)
- **On-demand production** and thus reduction of the dependence on supply chains as well as
- **Conservation** of material resources, as raw materials that are not printed can be recycled.
- **Saving** costs for e. g. moulds and post-processing
- **Significant shortening** of development cycles

Besides component development and fabrication with already established additive processes, the HTL also develops new techniques including the associated 3D printer devices.







Stereolithography-based 3D Printing

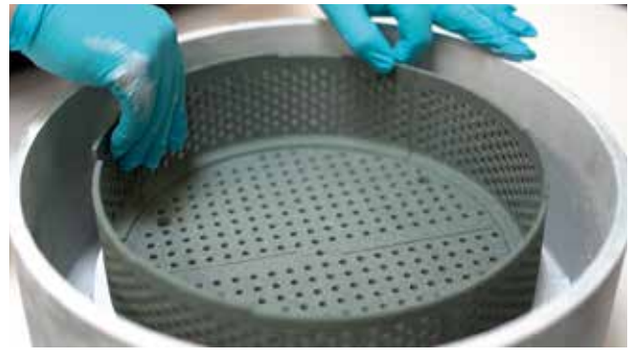
This technique is particularly suitable for glass, glass ceramics and ceramics. The components produced this way have a high density, excellent mechanical properties and a high surface quality.

Binder Jetting

This technique allows to process a wide range of ceramic, metallic and metal-ceramic materials. It has a high throughput and is well suited for combination with melt infiltration processes.

Free Flow Structuring

This novel slurry-based technique is suitable for ceramics and metals. It enables the shaping of large components from fine primary particles and is offered including the associated 3D printers.



Digitalisation of the Process Chain

Additive manufacturing enables the integration into a digitalised process chain like no other manufacturing method, as CAD data is transferred directly into production. If desired, the HTL also offers topology optimisation at component design stage and provides support in material selection and microstructure design.

The heat treatment is optimised using digital furnace twins. In case of two-stage AM processes, which are most relevant for powder-metallurgical products such as ceramics and sintered metals, they are as essential for component quality as the shaping process.

Assessment of component quality is performed using computed tomography and finite element methods.