Partial segment of an exhaust mixer made of low cost CMC

Service Offering

Our customers receive specific solutions depending on the intended use. The developments are carried out on direct order or within joint projects. The methods used are mostly standardized. Many experimental and computer-based methods are coordinated with each other, so that the developments can be carried out very efficiently according to ICME (Integrated Computational Materials Engineering).

- Development of new high-temperature materials
- Optimization of existing high-temperature materials
- Determination of application requirements and material selection
- Ceramic design of high-temperature components
- Production of prototypes and small series
- Testing of high-temperature materials and components
- Service life analyses
- Studies of high temperature materials

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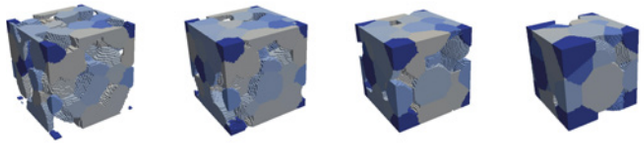
Das Fraunhofer-Zentrum HTL
ist nach ISO 9001:2015 zertifziert

Fraunhofer ISC

Center for High Temperature Materials and Design HTL

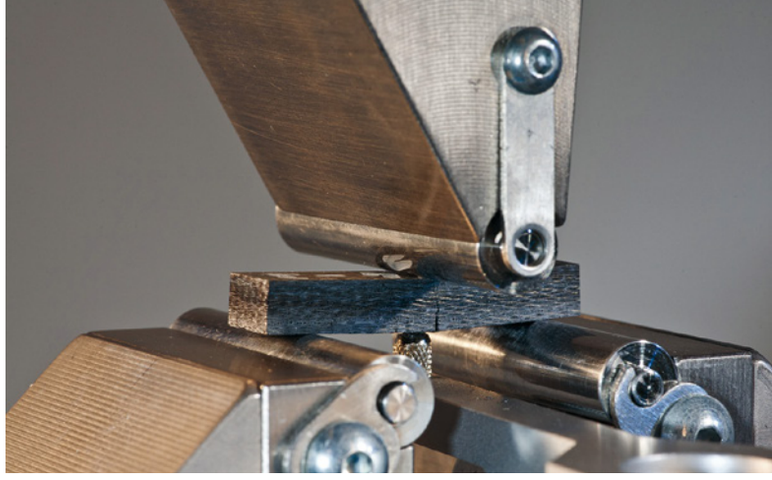
High Temperature Materials and Components

High Temperatures – Efficient Solutions



Computer Based Methods

- Finite element software: ANSYS and COMSOL
- Kinetic models: In-house software KINCAL, DEBIND
- Thermodynamics and material selection databases: Factsage, CES Selector, MPDS Materials Platform for Data Science, MPDB Material Properties Database
- Microstructure design: In-house software GEOVAL



High Temperature Materials and Components

Components used at high temperatures must meet special requirements. They are often exposed to corrosive atmospheres or rapid temperature changes as well as mechanical loads. They also contribute to thermal management in the thermoprocessing equipment in which they are used, which requires the specific adjustment of thermal transfer properties and thermal capacity.

High Temperature Components

At Fraunhofer Center HTL, high-temperature-stable ceramics are developed and optimized in various modifications: monolithic, porous, as coatings, fibers or fiber-reinforced composite ceramics (CMCs). The HTL covers the entire development chain: starting with the design of components and the definition of material requirements, through laboratory and pilot plant trials, to the production and testing of prototypes and small series. In this way, new components and materials for sustainable thermal processes are developed in a targeted manner.

Methods

The HTL uses FE methods for coupled thermal and mechanical component design. The material selection is supported by material databases, material indices and thermodynamics software. Specialized microstructure property simulation software is used to develop optimal microstructures for multiphase ceramics.

The HTL has all relevant methods for the production and characterization of ceramic slurries. Numerous processes are available for shaping and wet-chemical coating. Various 3D printing processes can also be used for prototyping. The thermal treatment processes can be carried out in different furnaces with temperatures up to 2400 °C and in all industrially relevant atmospheres in useful volumes of up to up to 0.5 m³.

Different non-destructive, mechanical and thermal methods are used to test the components.

Technische Anlagen

Werkstoff- und Bauteilherstellung

- Mischer, Mühlen, Dispergierer
- Trockenpressen, Extruder
- 3D-Drucker: Binder-Jetting, Stereolithographie, In-House-Verfahren, Free Flow Structuring (FFS)
- Wärmebehandlungsöfen: Nutzvolumen 1 bis 400 l
- Ofengase: Wasserstoff, Brenngas, Inertgase, Luft, Überdruck, Vakuum
- In-situ-Messverfahren: Dimensionsanalyse, Massenänderung etc.
- Endbearbeitung/Fügen: 5-achsiges Bearbeitungszentrum, Laserfügezentrum

Bauteilprüfung

- Zerstörungsfreie Prüfverfahren: Computertomografie, Ultraschall, Thermografie, Terahertzwellen
- Thermooptische Prüfverfahren: mechanisch, thermisch, chemisch, optisch, elektrisch