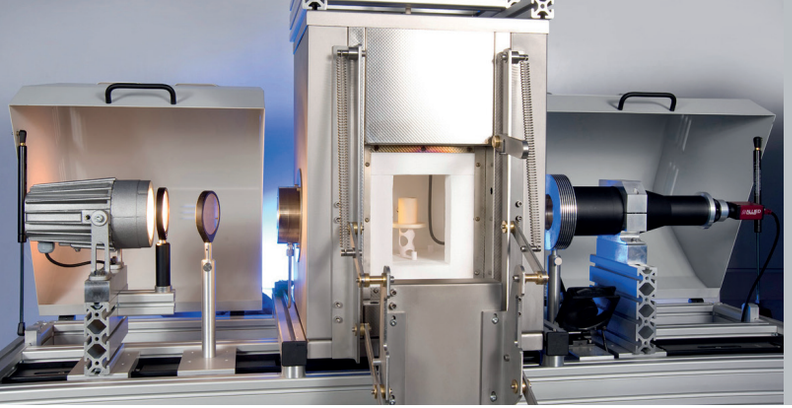

Fraunhofer ISC

FRAUNHOFER-CENTER FOR
HIGH TEMPERATURE MATERIALS AND DESIGN HTL

Technical Data

Measurement procedure for optimization of the debinding

- Loss of mass (thermogravimetry)
- Heat of reaction (dynamic differential scanning calorimetry)
- Gas analysis (mass spectrometry/CO_2 detection)
- Optical monitoring (optical dilatometry)
- Acoustical monitoring (noise emission analysis)
- Thermal conductivity (Laser-Flash analysis)
- Binder composition (element analysis)
- Green strength (e.g. ball on ring method)
- Binder wetting (optical contact angle analysis)
- Gas permeability (permeation measurement)

Coupled FE simulation

- Thermal calculations (COMSOL, ANSYS)
- Kinetic models (COMSOL)
- Fluid mechanical calculations (COMSOL)
- Structural-mechanical calculations (COMSOL, ANSYS)

Please feel free to contact us:

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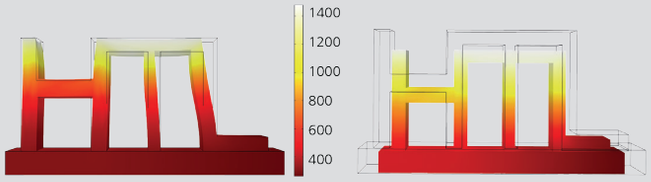
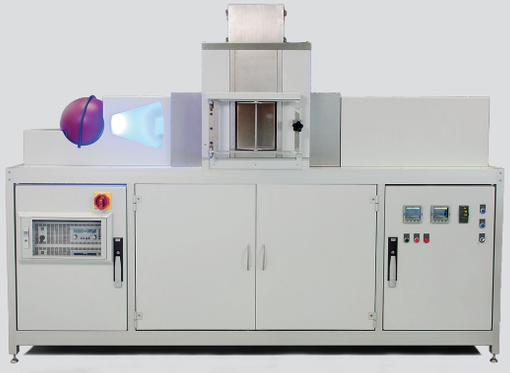
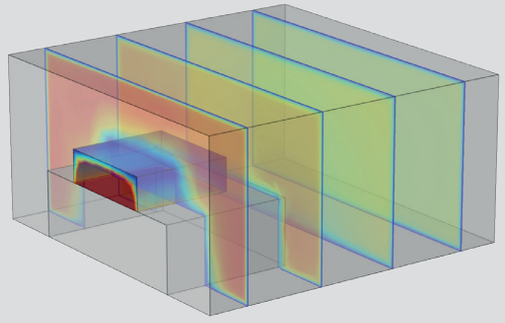
Quality Management ISO 9001:2015

Optimization of Debinding







Optimization of Debinding Processes

The debinding of green bodies is accompanied by desired as well as undesired physical and chemical processes. Associated with this are process-related problems that should be avoided:

- Damage to the structure
- Incomplete debindings
- Structural changes
- Long process duration

To counteract these problems, exact knowledge of the debinding process and the material to be examined are required. With special methods developed at HTL, the debinding processes can be characterized and accurately optimized. The procedure is divided into the following steps:

- In-situ characterization
- FE-simulation
- Optimization of the debinding parameters

With the aid of these methods, debinding processes can be optimized in terms of their cost and energy efficiency as well as their product quality.

In-situ Characterization

Using conventional thermal analysis methods as well as special ThermoOptical Measurement systems (TOM), green bodies are characterized during debinding. This enables the calculation of temperature cycles with constant debinding rates. The still safe maximum debinding rate is then determined by experiment. For this purpose, the damage to samples or small components during debinding are detected using noise or gas emissions. With larger components, a finite-element (FE)-simulation is performed.

FE-simulation

HTL has a coupled FE-model, which can be used to calculate the thermal effects, reaction kinetics, gas flow and gas diffusion as well as the mechanical stresses during debinding. In addition to the in-situ measured data, the simulation requires further experimental data for the composition of the organic binder, permeability of the pore channels, thermal conductivity and green strength. Thus, debinding for larger components can be calculated and debinding cycles are optimized.

Our Services

HTL offers diverse services for debinding (binder burn out, pyrolysis) in all industrial-relevant furnaces.

- Optimization of temperature-time cycles for small components using in-situ measurements and kinetic field technology
- Optimization of the temperature-time cycles for larger components by experimentations and FE-simulation
- Transfer of debinding cycles to industrial furnaces
- Optimization of the placement schemes and gas flows
- Evaluation of commercially available binders
- Evaluation of the green body sample quality

If necessary, at HTL further heat treatment stages can be examined and optimized. This includes the drying of green bodies, the dehydration of silicate ceramics or sintering.