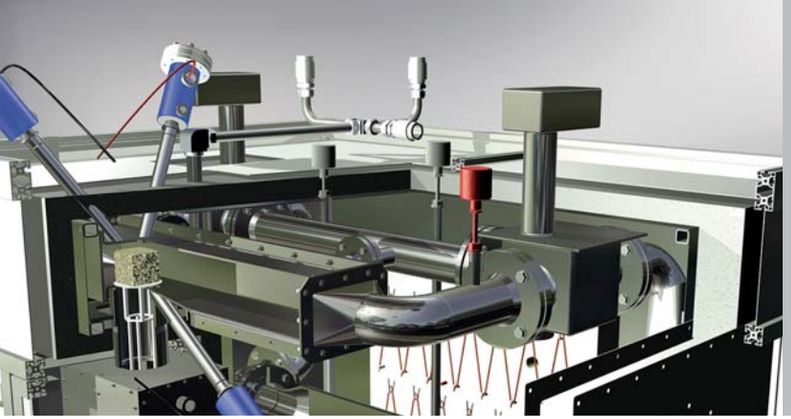

Fraunhofer ISC

FRAUNHOFER-CENTER FOR
HIGH TEMPERATURE MATERIALS AND DESIGN HTL

Optimization using Simulation Tools

With specially developed simulation tools, the precisely measured material behavior can be scaled up to any component geometry. Thus the processes can be optimized very efficiently in terms of material and energy efficiency on the computer. This combined approach is suitable for all types of development tasks and avoids time-consuming and costly trials during production:

- Measurement of thermo-physical properties in ThermoOptical Measurement systems (TOM)
- Parametrization of data – espescially the kinetics of the thermally activated reactions are represented in robust models
- Optimization of heat treatment processes using FE-simulation including the interaction between product and furnace set-up
- Lab validation and transfer of lab results to production scale

Furnace Inspection and Energy Efficiency

The quality of a heat treatment process is strongly influenced by the distribution of temperature and atmosphere in the furnace. These can be monitored at defined positions and with high accuracy using specialized equipment:

- Measurement of the temperature distribution using inhouse developed and calibrated temperature indicators
- Analysis of the local atmosphere and flow rate in the furnace using high temperature detectors and gas sampling lances

Please feel free to contact us:

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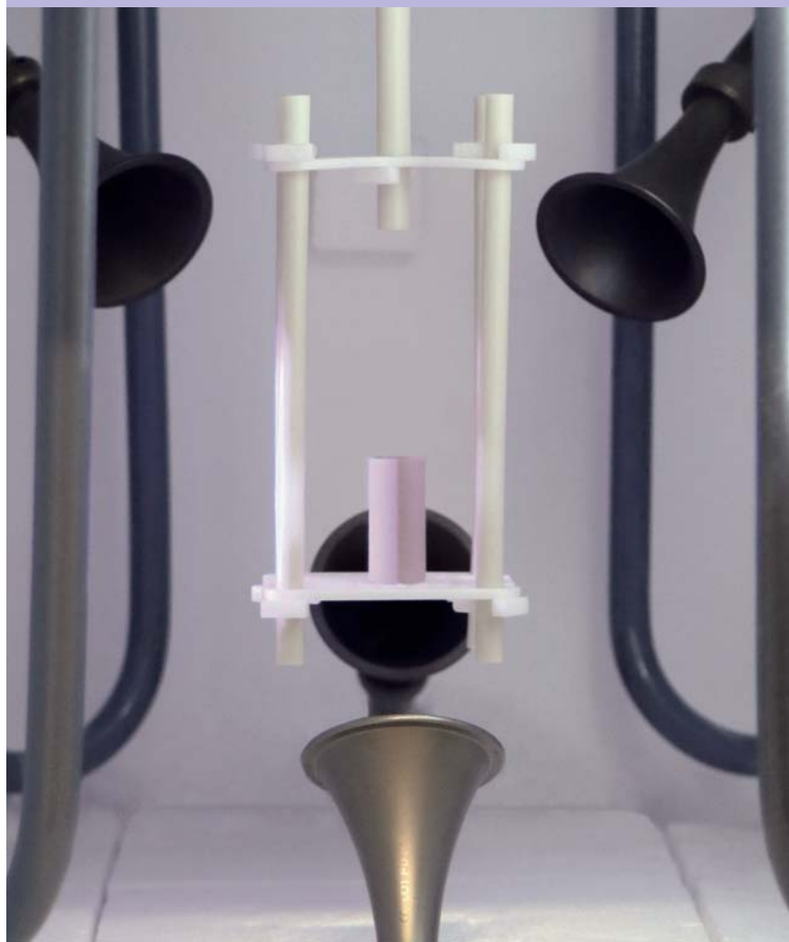
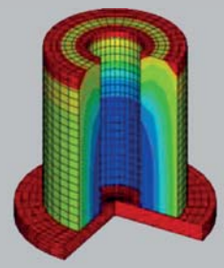
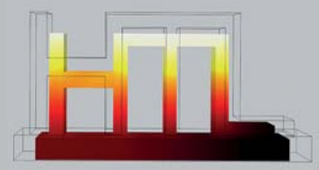
Quality Management ISO 9001:2015

Optimization of Heating Processes







Optimization of Heating Processes

Fraunhofer-Center HTL optimizes heating processes for the production of ceramics, metals and metal-ceramic-composites.

- Target: Production of top-quality products without defects at a minimum expense of energy and material
- Important: The optimization methodology yields cost reduction and quality intensification at the same time

Benefits

- Minimization of energy losses
- Maximization of throughput
- Improved process control
- Minimization of scrap

Thermal Processes which can be optimized cover

- Drying
- Dehydration
- Binder burnout / Pyrolysis
- Sintering
- Metal infiltration (reactive / passive)

Approach

Every process and material shows its unique characteristics. A systematic approach with accurate measurement equipment under well-defined measurement conditions is used, optionally complemented by special simulation techniques.

Best Practice

- Review of thermo-physical properties
- Thorough inspection of the industrial furnace including:
    - Temperature and local temperature distribution
    - Composition and flow rate of process gases
- Reproduction of industrial process conditions in Thermo-Optical Measurement systems (TOM) with respect to:
    - Atmosphere
    - Temperature
- In-situ characterization of material properties along thermal process with ThermoOptical Measurement systems (TOM)
- Simulation of material behavior under process conditions
- Verification of results
- Transfer of results to industrial furnace

In-situ Characterization

Our ThermoOptical Measurement systems (TOM) give the possibility to reproduce industrial heat treatment processes at lab scale.

All common furnace atmospheres can be reproduced: gas burner atmosphere, air, inert gases, forming gas, hydrogen, vacuum, over pressure etc.

Detectors record material changes and the thermo-physical properties during the heat treatment at highest accuracy.

Important quantities along the thermal process that can be measured using in-situ characterization:

- Mass change and gas emission during drying, dehydration, debinding and sintering
- Dimensional changes and deformation during drying, debinding and sintering
- Sound detection with regard to crack / defect formation
- Wetting behavior
- Creep rates and viscosity as a function of temperature
- Thermal shock resistance
- Change of thermal diffusivity during sintering