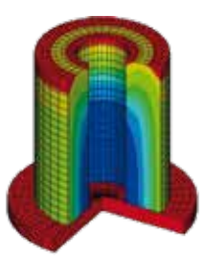

Optimisation Using Simulation Tools

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

- Measurement of thermophysical properties in ThermoOptical Measuring systems (TOM)
- Parametrisation of data – espescially the kinetics of the thermally activated reactions – are represented in robust models
- Optimisation 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 specialised 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

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Center for High Temperature Materials and Design HTL

Optimisation of Thermal Processes

High Temperatures – Efficient Solutions

Optimisation of Thermal Processes

Fraunhofer-Center HTL optimises heat treatment processes for the production of ceramics, metals and metal-ceramic composites.

Advantages

- Minimisation of energy loss
- Maximisation of throughput
- Improved process control
- Minimisation of rejects

Optimisable Thermal Processes

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

Concept

Heat treatment processes are optimised material-specifically for the heat treatment material under consideration. This is done systematically on the basis of precise measurement methods and under clearly defined measurement conditions, supported by special simulation techniques depending on the case.

Procedure

- Recording of the thermophysical properties
- Inspection of the industrial furnace including:
  - Temperature and local temperature distribution
  - Composition and flow rate of process gases
- Adjustment of industrial process conditions in Thermo-Optical Measuring systems (TOM) with regard to:
  - Atmosphere
  - Temperature
- In-situ characterisation of material properties via ThermoOptical Measuring systems (TOM)
- Simulation of material behaviour during heat treatment
- Verification of the results
- Transfer of the results to the industrial furnace
- Optional: Development of problem-specific apps for independent process optimisation by the customer

In-situ Characterisation

Our ThermoOptical Measuring 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 the material changes and thermophysical properties during the heat treatment with the highest precision.

Range of Possible Measurements

- Mass change and gas leakage during drying, dehydration, debinding and sintering
- Dimensional change and deformation during drying, debinding and sintering
- Acoustic emission detection with regard to the formation of cracks or defects
- Wetting behaviour
- Creep behaviour and viscosity
- Thermal shock resistance
- Change in thermal diffusivity during sintering