Services

The investigation of thermal process plants can be carried out in various levels of detail: from a simple thermographic examination of the furnace to the creation of a digital furnace twin and the implementation of a furnace control system.

- Qualitative 3D thermography and quantitative analysis of heat losses
- Measurement of temperature distribution in the effective volume
- Measurement of the furnace atmosphere
- Measurement of gas flow and heat radiation in the furnace
- Creation of a digital furnace twin
- Optimisation of the process kinetics for the material to be heated
- Optimisation of the furnace control

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

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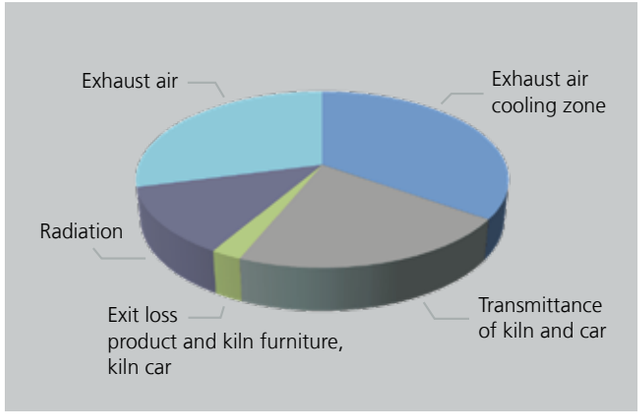
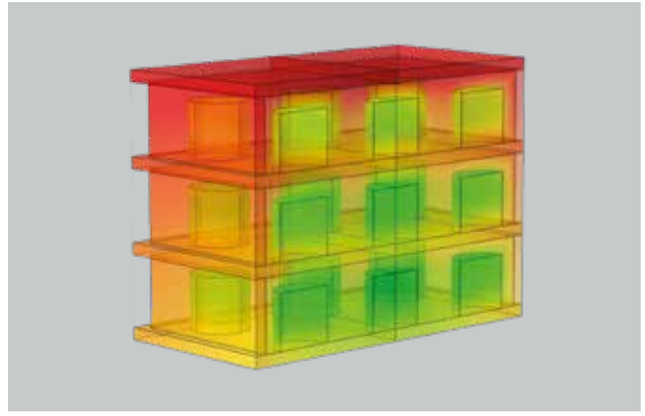
Controlling Industrial Thermoprocesses





Controlling Industrial Thermoprocesses

Application

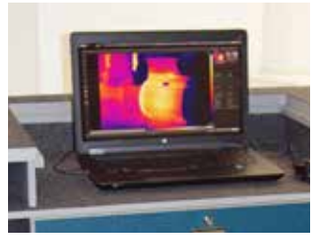
Industrial heat treatment facilities often provide large potential for optimisation in terms of cost and energy efficiency as well as the product quality achieved. Optimisation approaches can address the topics furnace insulation, setting plans, kiln furniture, temperature cycles and furnace atmospheres – the latter in terms of composition and gas flow.

Precise optimisation is not possible if the furnace is treated as a black box in an input-output analysis, but requires detailed data about kiln operation. Therefore, sensor technology for industrial furnaces is being developed at Fraunhofer-Center HTL. The sensors can be used for permanent furnace monitoring and control as well as for temporary acquisition of furnace data.

Measuring Methods

3D thermography and the measurement of heat flows are used to identify heat leaks and evaluate the resulting heat losses. Measurements of furnace atmosphere, radiation and temperature distribution, on the other hand, are needed to assess the quality of the heating process.

The HTL has electrochemical and optical sensors with which critical gas types (for example CO, O_2, CO_2, SO_2, NO_2, C_xH_y) are analysed in the furnace exhaust gas or by means of gas sampling lances. Gas flows are measured with a differential pressure sensor and heat radiation with a radiation sensor. The temperature distribution inside the furnace is recorded with specially conditioned and calibrated temperature measuring rings or a mobile autonomous sensor module.



Implementation

Depending on requirements, a simplified finite element (FE) or CFD model of the furnace system can be created from the data measured at the furnace (exhaust temperatures and composition, gas and radiation flows etc.). Using the digital furnace twin, changes in insulation, flows or heating parameters can be visualised and their effects on furnace operation and the product can be investigated.

The combination of the digital furnace twin with the simulation of the process kinetics in the material to be heated (drying, debinding, sintering, melt infiltration) developed at the HTL enables overall optimisation for many heat treatment processes considering both product quality and energy efficiency.

Permanent sensors can be integrated into efficient furnace control with the help of the digital furnace twin and machine learning methods available at the HTL.