Characterization of Thermal Behaviour of Materials and Processes
Investigation Methods+
Laboratory Thermal Analysis and Thermal Physics

Fraunhofer IKTS

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Effect	Method		Parameter
Length change Thermal Expansion, Shrinkage, Swelling, Transformation, …	**Thermomechanical Analysis**	**TMA**	-180 °C … 900 °C
	Thermodilatometry*	**TD**	RT … 2100 °C
	Optical Dilatometry*	**EHM / opt. TD**	RT … 1750 °C
Caloric Effects Enthalpy Change, Transformation	**Differential Scanning Calorimetry***	**DSC**	-180 °C … 1600 °C
	Differential Thermal Analysis*	**DTA**	-180 °C … 2400 °C
	Calvet-Calorimetry	**C-Kal**	RT … 300 °C
Mass change Debinding, Dewaxing, Outgassing, Reduction, Oxidation, Carbonization, Nitridation, …	**Thermogravimetric Analysis***	**TGA**	-180 °C … 2400 °C
	High capacity TGA		Sample mass up to 500 g or sample size up to 60 mm diameter or height
Sample-Gas-Interaction Debinding, Dewaxing, Outgassing, Reduction, Oxidation, Carbonization, Nitridation, …	**Evolved Gas Analysis***	**EGA**	-180 °C … 2000 °C
	Gas Detector		
	Mass Spectrometer		
	FTIR -Spectroscope		
	Humidity Sensor		
	Oxygen Measuring Cell		
Thermophysical properties			
Thermal Expansion coefficient / density ρ(T)	**Thermomechanical Analysis***	**TMA**	-180 °C … 900 °C
	Thermodilatometry*	**TD**	RT … 2000 °C
Specific Heat $C_P(T)$	**Differential Scanning Calorimetry***	**DSC**	-150 °C … 1500 °C
Thermal Diffusivity a(T)	**Laserflash-Analysis***	**LFA**	RT … 1500 °C
Thermal Conductivity λ(T)	**$\lambda(T)=\rho(T)*C_P(T)*a(T)$**		RT … 1500 °C
Thermal Conductivity	**Heat Flow Measurement**	**WFM**	RT
Electrical Conductivity	**Resistance - in situ Measurement**	**RIS**	RT … 1000 °C
Wetting	**Heating Microscopy***	**opt. TD / EHM**	RT … 1750 °C
Phase Composition	**High Temperature – XRD**	**HT-XRD**	RT … 1500 °C
Thermokinetic Modelling	**Kinetic Field of Response** **Master Curve** **Thermokinetic (Netzsch)**		Length change, caloric effects, mass change, sample-gas-interactions
Thermodynamic Modelling	**FactSage**		Phase composition

*Special equipment for high purity or corrosive or potentially explosive or water vapour atmospheres.

Thermal processes as well as states and change of states of materials are investigated, simulated and optimized.

The complex characterization and optimization of the thermal behaviour of materials, components and processes including the determination of thermophysical properties for modelling and simulation purposes are offered based on a multitude of combined or simultaneously usable thermoanalytical and thermophysical methods as well as long-standing experiences in this field.

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