



## Thermochemical and Thermophysical Properties

Knowledge of thermochemical and thermophysical properties of compounds and substances mixtures is essential to develop and to design products and methods of technical applications. The Germany based Institute of Technical Thermodynamics operates a wide range of specialized measurement equipment as well as mathematical models to describe ideal and non-ideal behavior of fluids and solids.

### Experimental Measurements



▲ *Vapor pressure measurements: The transpiration method is one of the four methods that we use to determine vapor pressures in every desired temperature and pressure range*

Thermophysical properties are the basis for industrial research and process optimization implementation. The increasing number of synthetically manufactured substances as well as mixture combinations and materials extending operation range demand accurate measurement of thermochemical properties. We offer advanced high-precision measurement techniques on scientific level and provide reliable and reproduceable scientific data.

We have many years experience of calorimetric measurements and the investigation of phase equilibria. This includes high-precision combustion calorimetry, phase transition enthalpies measurement and vapor pressures determination in the widest possible pressure and temperature range. Using heat capacity measurements, experimentally determined thermochemical properties can be adjusted to all temperatures under that you need the data.



▲ *High precision combustion calorimetry: With our special combustion calorimeter, we can determine combustion enthalpies and enthalpies of formation with a precision that is up to 10 times higher than the results from commercial devices*

## Measurement Technique

	Properties	Range	Accuracy
<b>Combustion calorimetry</b>	Enthalpy of combustion, enthalpy of formation	298.15 K (Experiment) 250.15 – 500.15 K (Adjustment)	± 0.1 % ± 3 kJ·mol <sup>-1</sup>
<b>Vapor pressure measurements</b>	Vapor pressure, enthalpy of vaporization, enthalpy of sublimation	250.15 – 470.15 K 10 Pa – 1.6 MPa (Static Method)	± 0.3 - 1 % (Vapor pressure) ± 0.5 kJ·mol <sup>-1</sup> (Enthalpy)
		270.15 – 520.15 K 0.1 to 1000 Pa (Transpiration)	± 2.5 % (Vapor pressure) ± 0.5 kJ·mol <sup>-1</sup> (Enthalpy)
		300.15 – 520.15 K 1 mPa – 10 Pa (Knudsen)	± 5 % (Vapor pressure) ± 2 kJ·mol <sup>-1</sup> (Enthalpy)
		320.15 – 520.15 K 1 µPa – 100 µPa	± 30 % (Vapor pressure) ± 1 kJ·mol <sup>-1</sup> (Enthalpy)
<b>DSC and Flash-DSC</b>	Enthalpy of fusion Specific heat capacity	183.15 – 573.15 K	± 1 %
<b>Solution calorimetry</b>	Enthalpy of solution Enthalpy of formation	293.15 – 333.15 K	± 1 kJ·mol <sup>-1</sup>
<b>Viscosimetry</b>	Dynamic viscosity	243.15 – 473.15 K	± 1 %
	Dyn. & Kin. viscosity	253.15 – 373.15 K	± 0.35 %
	Density	253.15 – 373.15 K	± 0.08 – 0.1%
<b>Densimetry</b>	Density	263.15 – 473.15 K max. 140 Mpa	± 5 · 10 <sup>-6</sup> g·cm <sup>-3</sup>
	Density	278.15 – 343.15 K	± 5 · 10 <sup>-6</sup> g·cm <sup>-3</sup>
	Speed of sound	Ambient Pressure	± 0.1 m·s <sup>-1</sup>
<b>Fluid-phase-equilibria</b>	Gas solubility: Oxygen, Hydrogen, carbon dioxide, ....	273.15 – 473.15 K max. 5 Mpa	± 0.001 mol/kg
	Water solubility	283.15 – 353.15 K (Karl-Fisher) 278.15 – 353.15 K (Cloud point)	± 5 % ± 0.1 K
<b>Tensiometry</b>	Surface tension	283.15 – 343.15 K Ambient pressure	± 2 %

### Key Benefits for Your Product

- Precise measurement technique on scientific level
- Validation of experimental results with a combination of experimental and theoretical methods
- Extended measurement range (p, T)
- Tailor-made models for your fluids

**Are you interested in further information?  
Feel free to contact our experts.  
Together we will find a solution for your challenges.**

As part of a cooperation agreement, the Institute of Technical Thermodynamics collaborates with the FVTR GmbH at the University of Rostock. This mutual work ensures the most accurate and reliable measurements and validation of thermochemical properties even if it is about a difficult research.

Our competences in the area of substance property measurements are confirmed by many publications in peer-reviewed journals. Our collaboration with leading national and international research groups expands the range of services we can offer.

We can support you with a variety of services with regards to substance properties – also with several competences beyond what can be summarized on a two-pager. So feel free to contact us.



### THERMOPHYSICAL PROPERTIES

Team Lead  
**Dr. rer. nat. Riko Siewert**

+49 381 498 9415  
riko.siewert@uni-rostock.de