

**LINSEIS**

*pushing boundaries*



**MEGA  
LAB**

Tel. 2310855844, 2106452848

Email. [contact@megalab.gr](mailto:contact@megalab.gr)

[www.megalab.gr](http://www.megalab.gr)

**STA L81**

# Simultaneous **Thermal Analysis**



[WWW.LINSEIS.COM](http://WWW.LINSEIS.COM)



Since 1957 LINSEIS Corporation has been delivering outstanding service, know-how and leading innovative products in the field of thermal analysis and thermo-physical properties.

Customer satisfaction, innovation, flexibility, and high quality are what LINSEIS represents. Thanks to these fundamentals, our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermoanalytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials, and environmental analytics. In addition, thermophysical properties of solids, liquids, and melts can be analyzed.

Rooted in a strong family tradition, LINSEIS is proudly steered into its third generation, maintaining its core values and commitment to excellence, which have been passed down through the family leadership. This generational continuity strengthens our dedication to innovation and quality, embodying the essence of a true family-run business. LINSEIS provides technological leadership. We develop and manufacture thermoanalytic and thermophysical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal analysis equipment.

The development of thermoanalytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

C L A U S   L I N S E I S  
C E O   D I P L .   P H Y S .



To strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is to constantly develop new technologies to enable continued discovery in Science.



# Engineering & Innovation

# Simultaneous Thermal Analysis

Simultaneous TGA-DTA/DSC measures both, **heat flow** and **weight change** of a sample as a function of temperature or time under controlled atmosphere. Simultaneous measurement of these two material properties not only improves productivity but also simplifies interpretation of the results. The complimentary information obtained allows differentiation between endothermic and exothermic events which have no associated weight change (e.g., melting and crystallization) and those which involve a weight change (e.g., degradation).

## STA

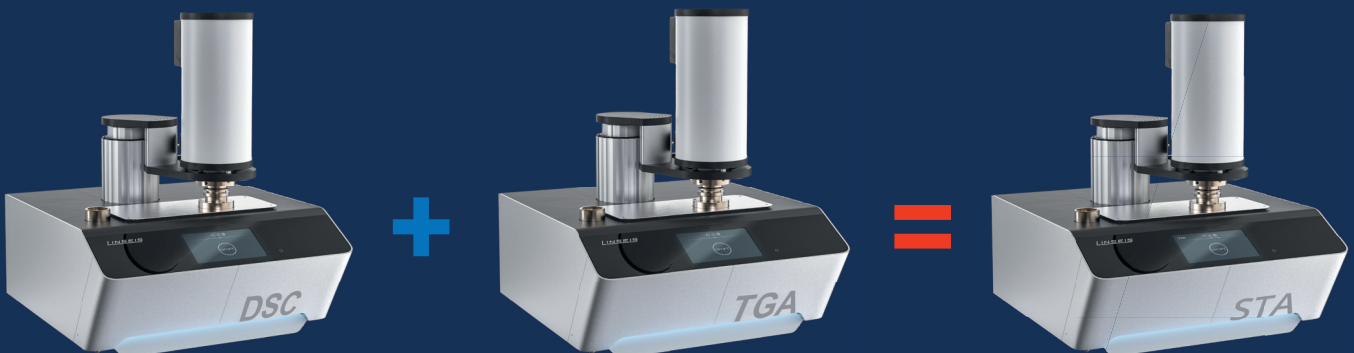
(Simultaneous Thermal Analysis)

## DSC

(Differential Scanning Calorimeter)

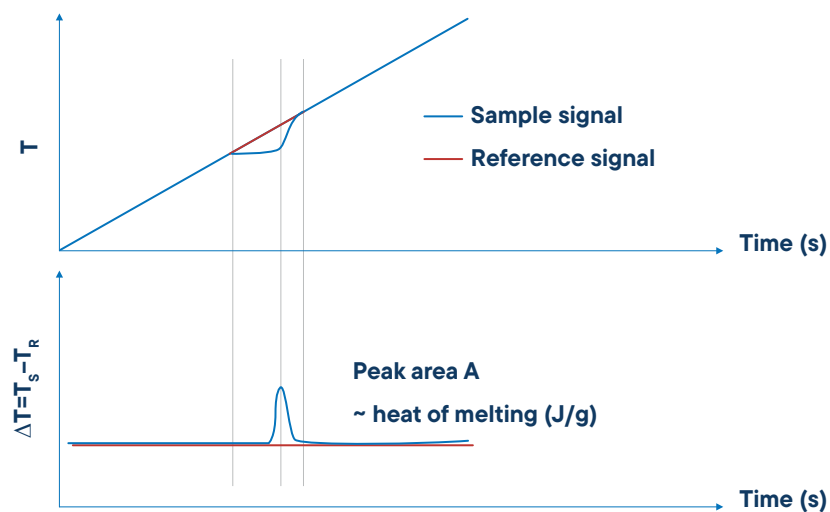
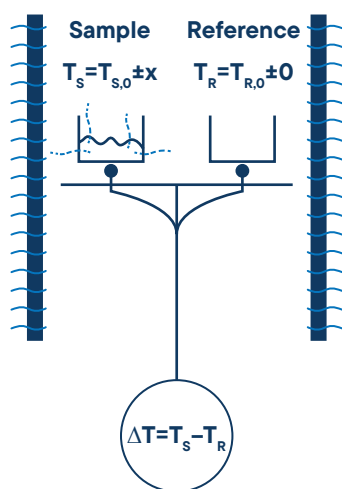
## TGA

(Thermogravimetry)



# DSC-True Heat Flow measurement

## Quantitative DSC-signal



### Differential Scanning Calorimetry (DSC)

A technique where the difference in energy input into a substance and a reference material is measured as a function of temperature, while the substance and reference material are subjected to a controlled temperature program.

### Differential Signal

The differential signal is displayed as a baseline. Effects, for example the melting of a metal, can be observed as a peak. The area of the peak gives the amount of enthalpy and the direction of the peak indicates the way of heat flux – endothermic (down) or exothermic (up).

### Temperature vs. Time

During an effect like a reaction, decomposition or phase transition, a temperature difference (heat flux difference) between the sample and the reference crucible can be measured by means of a thermocouple.

### Measurable Properties

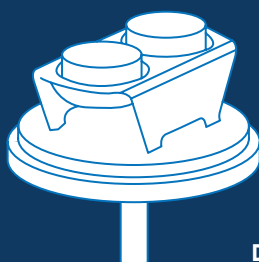
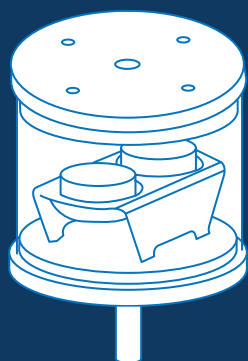
- Mass change in % and mg
- Rate controlled mass loss
- Evaluation of mass loss
- Residual mass evaluation
- Compositional analysis
- Enthalpy
- Endo- / exothermic reaction
- Phase transition
- Melting point
- Glass point
- Crystallinity
- Thermal stability
- Oxidation stability
- Purity
- Solidus / Liquidus relationship
- Product identification

# Sensors

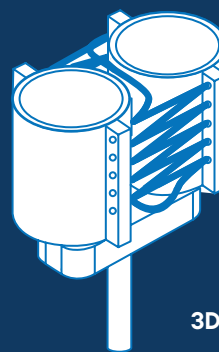
The Linseis STA can be equipped with an unmatched amount of different user exchangeable TG-DSC, TG-DTA or TG sensors. Each sensor is available with different thermocouples to provide the highest sensitivity for the desired temperature range and application. Additionally, there are multiple crucible types available that enables the user to find the matching combination for his application.

- Al<sub>2</sub>O<sub>3</sub>
- Platinum
- Aluminium
- others

## TG-DSC



DSC Heat flux



3D-Calvet-DSC  
sensor



0.12 ml



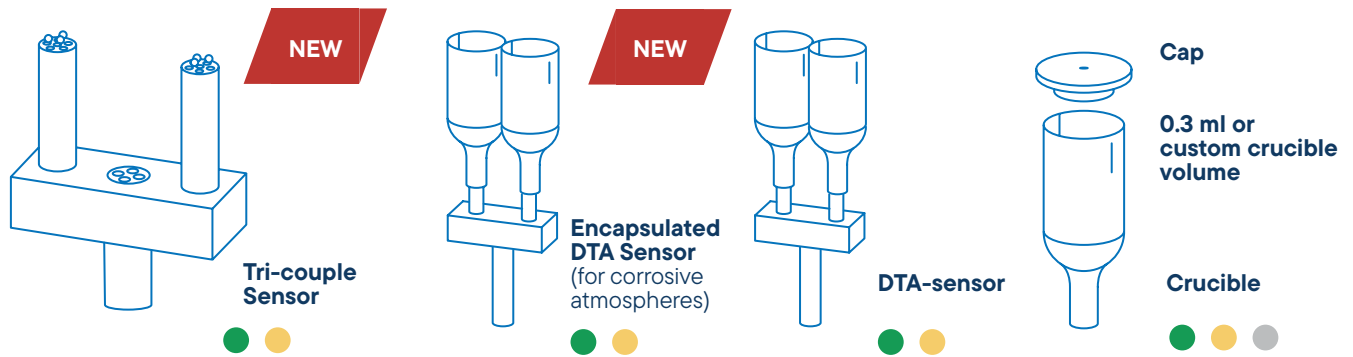
0.12 ml



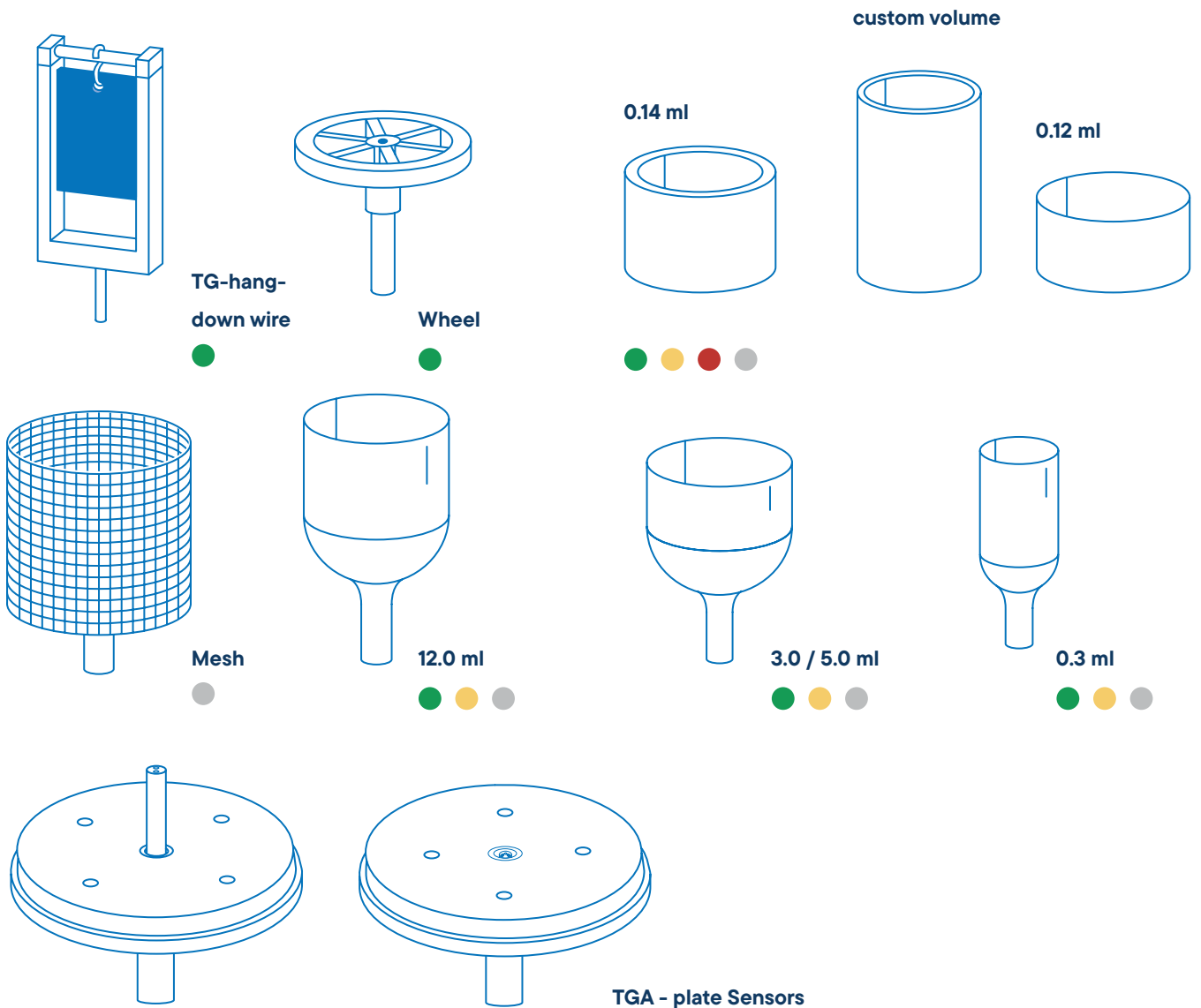
custom volume



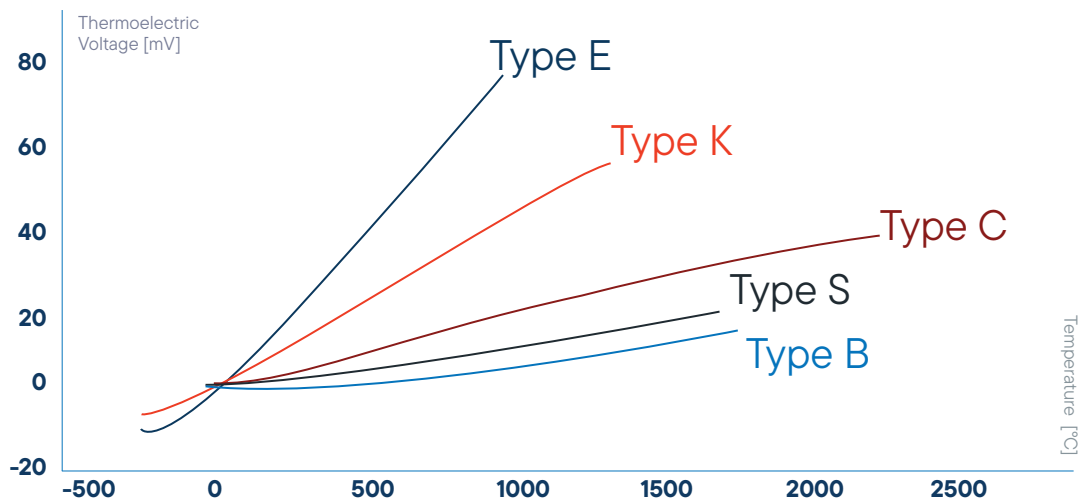
# TG-DTA



# TGA



# Best possible sensitivity for every application



## Thermocouple types:

- Type E** (Chromel)  
Constantan: -50 °C up to 900 °C
- Type K** (Chromel)  
Alumel: -180 °C up to 1100 °C
- Type S** (Platinum-Rhodium/10 %)  
Platinum: 0 °C up to 1600 °C
- Type B** (Platinum-Rhodium/30 %)  
Platinum-Rhodium (6 %): 25 °C up to 1800 °C
- Type C** (Tungsten/5 %)  
Rhenium: Tungsten (26 %)  
Rhenium: 20 °C up to 2300 °C

All sensors available with the thermocouples illustrated. LINSEIS sensor combinations cover the broadest temperature range in the market (-180 °C up to 2400 °C).

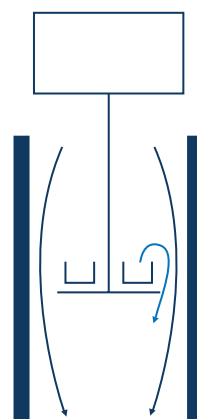
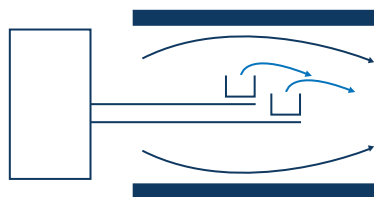
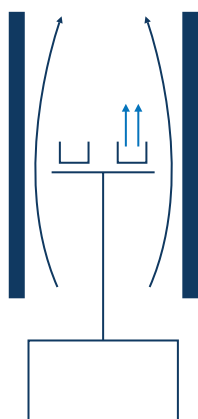
## Furnace Programm

Temperature	Type	Element	Atmosphere	TC-Type
-70°C - 400°C	L81/264/RCF	HangDown only Intracooler / Kanthal	inert, oxid., red., vac.	K
-150°C - 500°C	L81/264/500	Kanthal	inert, oxid., red., vac.	K
-150°C - 700°C	L81/264/700	Kanthal	inert, oxid., red., vac.	K
-150°C - 1000°C	L81/264/1000	Kanthal	inert, oxid., red., vac.	K
RT - 1000°C	L81/220 AC	SiC	inert, oxid., red., vac.	K
RT - 1600°C	L81/240 AC	SiC	inert, oxid., red., vac.	S
RT - 1750°C	L81/250	MoSi <sub>2</sub>	inert, oxid., red., vac.	B
RT - 2000°C	L81/260/G/2000	Graphite	inert, red., vac.	C
RT - 2400°C	L81/260/G/2400	Graphite	inert, red., vac.	Pyrometer
RT - 2800°C	L81/260/G/2800	Graphite	inert, red., vac.	Pyrometer
RT - 2400°C	L81/260/T	Tungsten	inert, red.	C
RT - 1000°C	L81/200	Glow igniter	inert, oxid., red., vac.	S/K

# Benefits of the vertical top loading design

The vertical “sample on top” design of the LINSEIS thermo-balance provides highest possible accuracy due to a stable position of the sample and easy sample handling.

TGA/ STA PT 1000/1600



## Vertical system (sample on top) LINSEIS configuration

### Advantages:

- Easy sample handling
- Easy exchange of sample holder
- Stable position of the sample in the furnace  
(critical for good DTA/DSC and Cp results)

### Disadvantage:

- Complicated construction

## Horizontal system

### Advantages:

- Small buoyancy effects

### Disadvantages:

- Very difficult sensor exchange
- Difficult sample handling
- Very high purge gas rate required
- Problems due to sensor expansion during heating/cooling

## Vertical system (sample on bottom)

### Advantage:

- Stable position within furnace

### Disadvantages:

- Difficult sensor exchange
- “Dangerous” gas flow within balance housing (sample gets blown out)
- Sensor position depends on sample weight

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# New features



## Electronic Upgrade

The new measuring electronics offer significant performance improvements, inspired by the architecture of the „Linseis Digital Balance“. The benefits of this new digital balance architecture include:

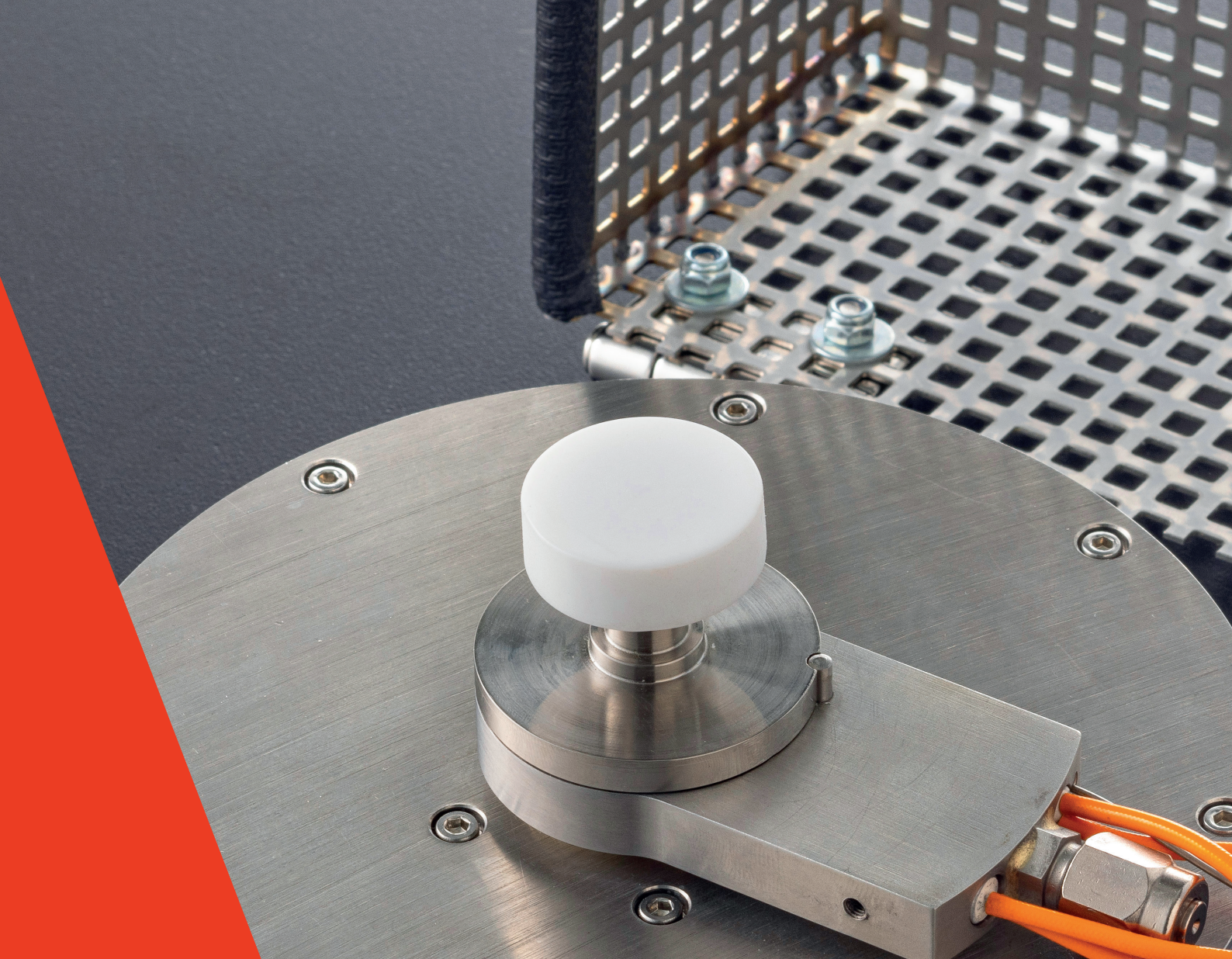
- **Minimization of drift:** Ensures consistently high precision over long periods of time.
- **Improved resolution:** Unique sub-microgram resolution.
- **Highest accuracy:** Improves the reliability of your measurement results.
- **Reproducibility:** Ensures consistent results with repeated measurements.

## Linseis Lab Link

With Linseis Lab Link, we offer an integrated solution to address uncertainties in measurement results. With direct access to our application experts via the software, you can get advice on the correct measurement procedure and evaluation of results. This direct communication ensures optimal results and maximizes the efficiency of your measurements for precise analysis and research as well as a smooth process flow.

## Software Improvements

- **Lex Bus Plug & Play:** Our latest hardware interface Lex Bus revolutionizes the way data communicates within our systems. Lex Bus enables seamless and efficient integration of new hardware and software tools.
- **Improved furnace control:** Our new and further improved furnace control offers a faster heating and cooling as well as more precise temperature control, which leads to better measurement results through better temperature sequencing according to your wishes and requirements.
- **New software with user interface:** Our communication is now even more focused on the needs of our customers to ensure that you are always informed of the latest status and receive support whenever it is needed.
- **Process security:** We have optimized our software for process security to ensure that your data is protected at all times and processed in a fail-safe manner.
- **Error messages and bug fixes:** Our system automatically detects errors and bugs, which are immediately documented and fixed to minimize downtime.
- **Automatic updates and new features:** Our software receives regular automatic updates that not only improve security, but also continuously provide new features.
- **Permanent system monitoring:** Our software constantly monitors the system parameters to ensure optimum performance.
- **Preventive maintenance and problem detection:** Our preventive maintenance approach detects problems and wear and tear before they can cause damage and keeps your device in top shape.



## Design Improvements

The new device design is characterized by an elegant aluminum casing that is both robust and aesthetically pleasing. The LED status bar provides a user-friendly visualization of important information. A touch panel enables intuitive operation and contributes to a modern user experience that combines comfort and functionality. The new device design focuses on ergonomic operation.

## New Hardware Features

- **Tri-couple DTA measuring system:** DTA measuring system with three sample thermocouples for the smallest endo-/exothermic effects in inhomogeneous samples
- **Jacketed DTA measuring system:** For corrosive samples
- **Patented „forced flow“ method:** Enables forced flow through your TG or TG-DTA. Our system enables forced flow through the sample, where by up to 100 % reaction gas is fed directly to the sample. This novel method enables scalable measurements for the first time, allowing precise analysis under real conditions.

# Unique features

## Automatic Evacuation

The devices feature a built-in automatic evacuation capability, ensuring efficient processes and smooth operation.

## Vacuum and controlled atmosphere

- Supports high vacuum, inert, reducing, oxidizing, or humidified atmospheres
- Optional pressurization up to 5 bar overpressure
- Analysis of certain corrosive conditions with precautions
- Adaptability for residual gas analysis with optional heated capillary

## Evolved gas analysis

Optional gas analysis with MS, FTIR, or GCMS is possible, providing valuable additional information. The system can be configured with standalone and integrated MFC for gas dosing. Additionally, customer-specific options such as a heated inlet can also be integrated into the device.

## Gas safety system

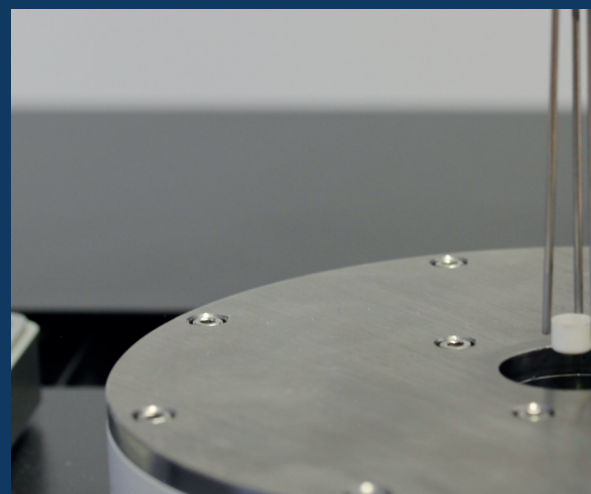
The gas safety system is designed to accommodate various gases such as hydrogen or carbon dioxide, ensuring secure operation and user safety.

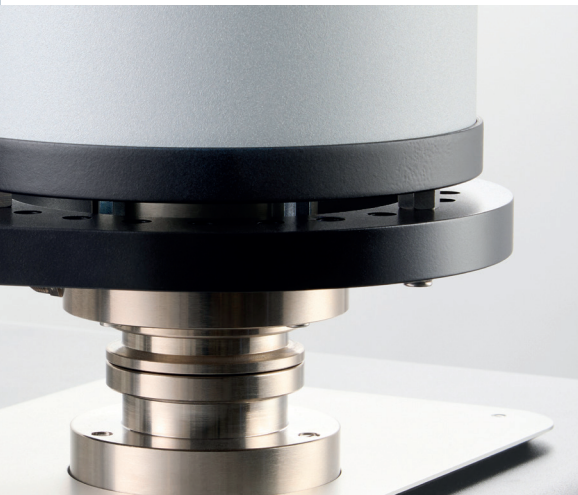
## Controlled humidity and water vapour

The device can regulate the humidity and water vapour during the measurement.

## Sample robot

Our STA L81 can be equipped with a proven sample robot for unattended sample measurements for highest throughput.





### **Wide temperature range -150 °C to 2400 °C**

The LINSEIS STA instruments can be equipped with up to two furnaces at the same time. A broad variety of different furnaces are available to enable measurements in the widest temperature range on the market.

### **Automatic calibration**

We offer an automatic calibration function in the software and hardware. With this function, our STA automatically calculates a calibration factor, which is also displayed.

### **Integrated LINSEIS platform**

The integrated LINSEIS software offers a comprehensive solution, combining both hardware and software for maximum process security and precision. By providing a unified platform, it ensures seamless integration of components and devices from external partners, resulting in a highly robust system.



### **Customization**

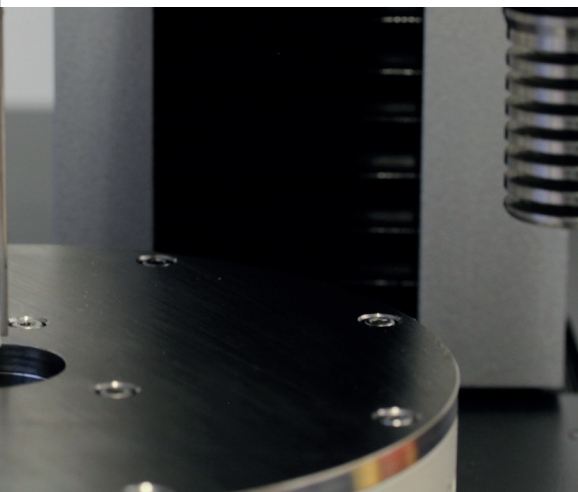
Close collaboration with the customers to tailor unique solutions, leveraging LINSEIS expertise to meet their specific needs.

### **Service**

Our international presence across every continent enables us to deliver the best and fastest service possible.

### **Accessories starter kit**

The accessory starter kit guarantees fast and uncomplicated usage, serving as a complete system for instant application.





## Equipment for gas control and safety (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)

All Linseis instruments can be prepared for the use in hydrogen atmosphere with just minor adjustments. The most important thing is a safety system that can ensure that there is no leakage and no explosive atmosphere generated outside of the instrument. Therefore, the Linseis safety system uses hydrogen sensors that are coupled to an automatic gas control panel. If there is a leakage or unwanted hydrogen release, the instrument is automatically flooded with inert gas and the hydrogen valves are closed. This ensures a minimum risk level during operation. Besides that, the system contains an optional burn off unit where the gas outlet is connected to, to ensure that also the used gas of the measurement chamber is not just released into the environment. The system can also be operated with several combinations of inert gases and even water vapor besides hydrogen.

### In summary, the Linseis safety system comes with the following benefits:

- Automatic evacuation function
- Gas flow control for multiple gases including water vapor and hydrogen
- Emergency shutdown function
- Gas detector system (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)
- optional burn off unit
- Continuous monitoring to ensure safe operating conditions



Fig. 1

# Linseis equipment for operation under water vapor and controlled relative humidity

For many applications in thermal analysis, the atmosphere plays an important role as it may affect the sample behavior or activate reactions. Humidity influence on building materials, storage time of pharmaceuticals and foods or influence on mechanical properties of polymers are just some of the most common examples. Of course, the Linseis instruments are suitable for such experiments, however there is one fact that is often causing confusion and must be considered carefully: The difference between water vapor and relative humidity.

Relative Humidity Generators are most commonly used for experiments around room temperature, while water vapor applications are most often at higher temperatures. When water is heated to its boiling point or higher than that, the water changes its aggregate form from liquid to gaseous. It is then existing as water vapor (steam). If this steam is introduced into any kind of reaction chamber or instrument, it is called water vapor application. In contrast, every gas can transport and contain a certain amount of water at a given temperature. This is called humidity. Considering air as an example, there is always an amount of water contained in the air, even below the boiling point of water, which is defined as grade of humidity or relative humidity.

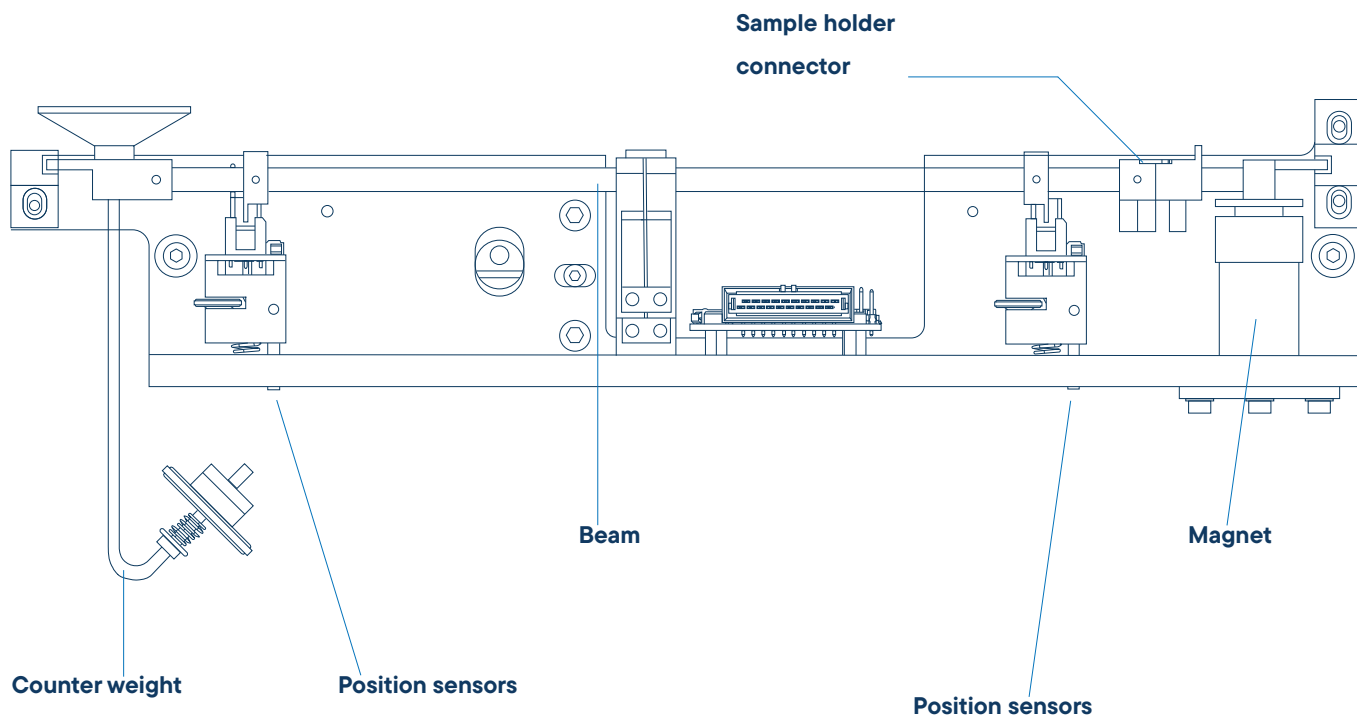


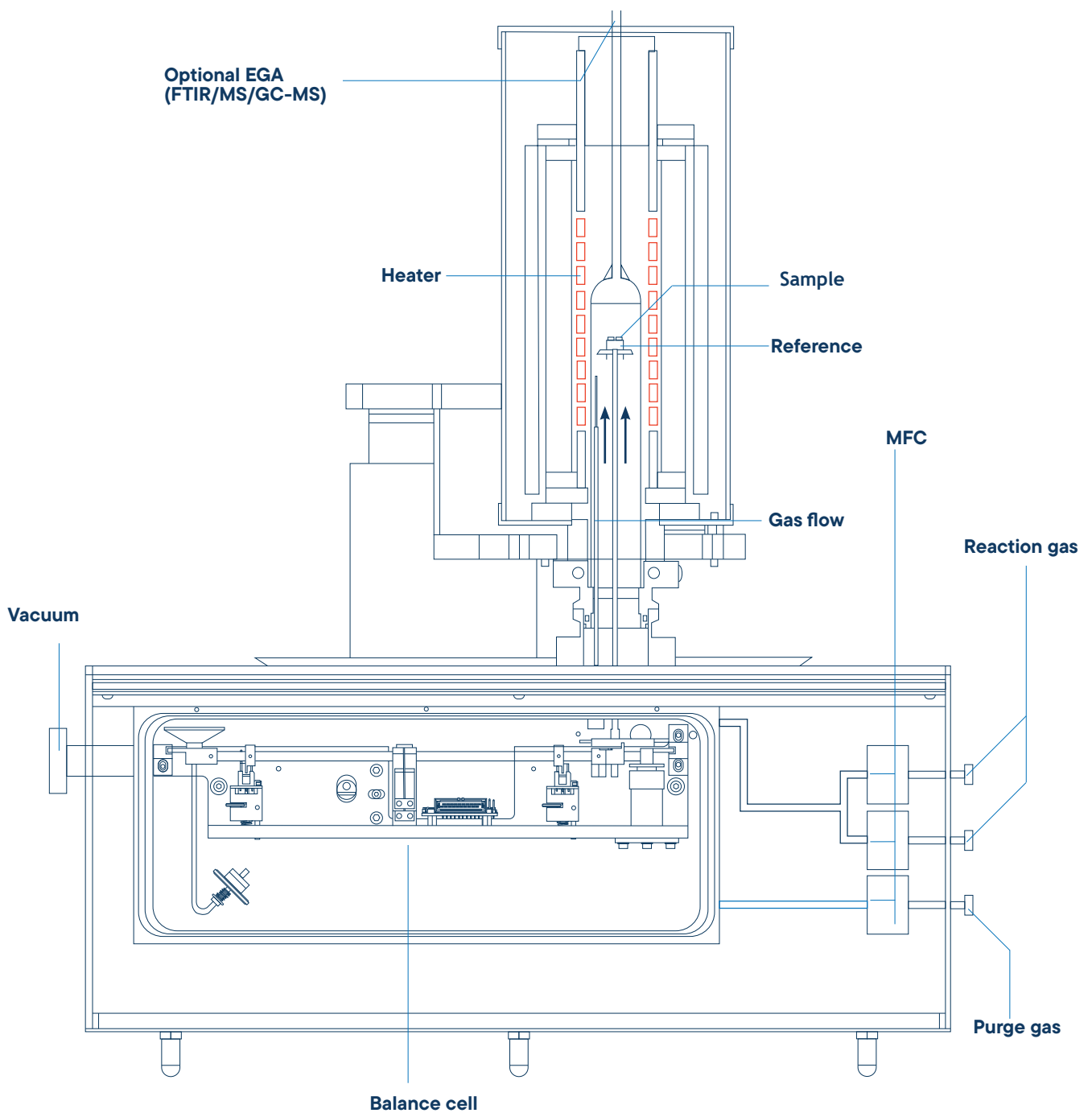
## Highest precision beam balance

Our different microbalances are specifically designed to accomplish thermal analysis tasks in the best possible way.

Providing ultra light weight design to follow fast weight changes and symmetric construction for ultra low drift long term measurements.

Linseis micro balance  
especially designed for  
thermal  
analysis instruments





### Advantages of LINSEIS balance design

- Sample mass compensation by a counterweight enables improved sensitivity
- Improve symmetrical design for high interference levels
- Not affected by local gravity
- Not affected by thermal fluctuations
- Highest possible PRECISION
- Concept enables easy maintenance
- Depending on model, balance can handle from mg up to 50 g sample mass

### Advantages of combined TG+DSC

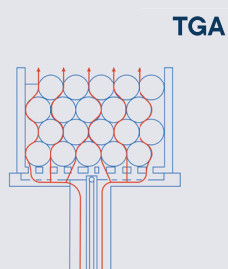
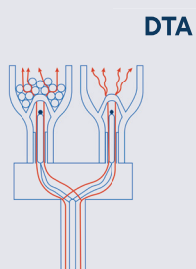
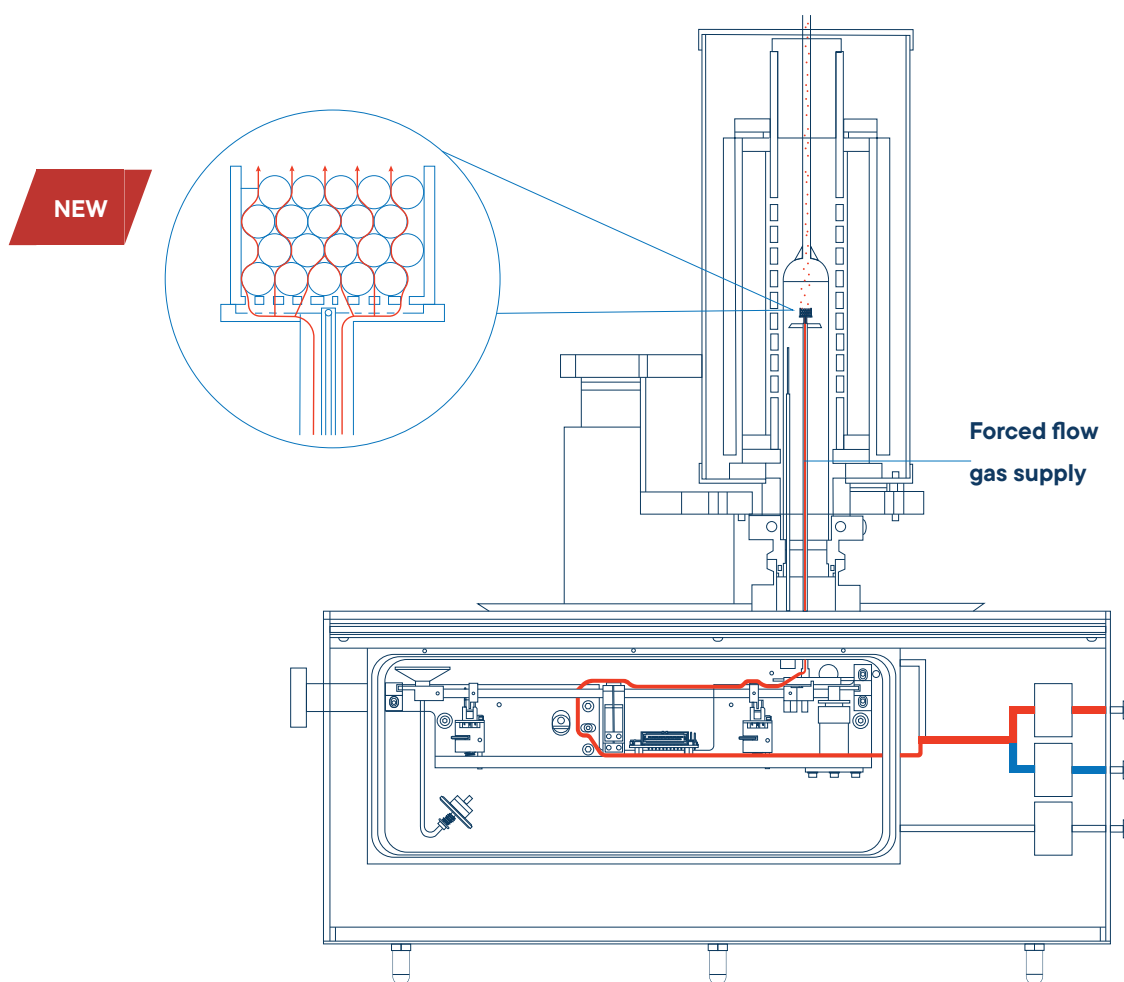
- Same geometry
- Stoichiometry
- Same temperature profile
- Same atmosphere
- Same humidity



## Forced-flow offers several advantages in the investigation of gas/solid phase reactions

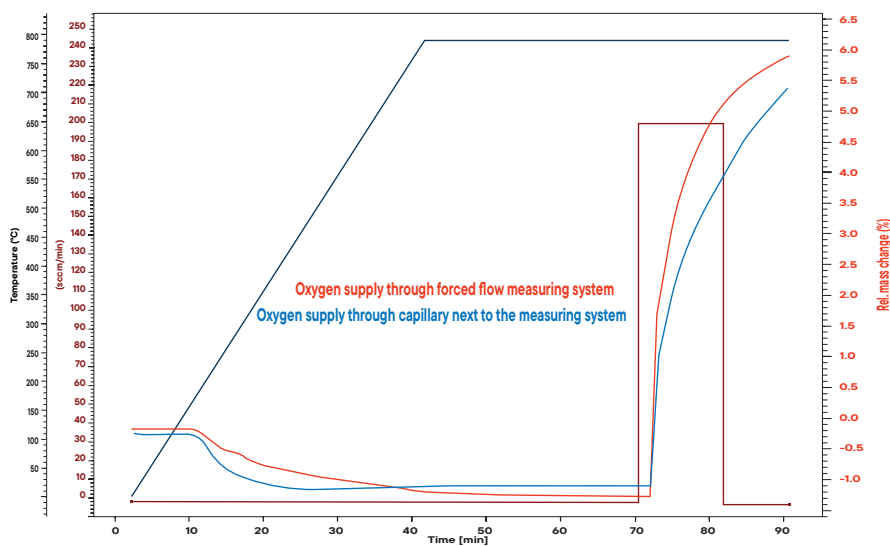
Patent pending

1. Controlled Conditions: Precise control of reaction conditions for a reproducible environment.
2. Faster Reaction Times: Acceleration of slow reactions through continuous flow.
3. Better Mixing: Uniform distribution of reactants for improved reaction kinetics.
4. Continuous Analysis: Enables real-time monitoring and control of the reaction.
5. Scalability: Easier adaptation to different volumes and flow rates for optimized production.

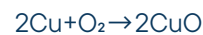


The Forced-Flow principle is available for both, Thermogravimetric Analysis (TGA) and Differential Thermal Analysis (DTA). The Forced-Flow principle extends its capabilities to the fields of thermogravimetry and differential thermal analysis, potentially leading to improved investigative methods and more accurate results.

## Oxidation rates of copper with different gas supplies



During the oxidation of copper, copper oxide is formed, with reaction speeds depending on the gas supply. The Forced-Flow principle ensures that the gas is quickly and evenly distributed across the entire sample material from the outset. This allows faster reaction rates compared to conventional methods where the gas slowly comes into contact with the sample. The reaction for the formation of copper oxide can be represented as:



The Forced-Flow principle ensures that the oxidizing agent ( $\text{O}_2$ ) reacts rapidly and efficiently with the copper ( $\text{Cu}$ ), leading to accelerated reaction rates.

The image shows a simulated fluidized bed. It is possible to observe the fluidized bed during the reaction using a camera. A fluidized bed is a system where solid particles are kept in motion by a gas stream, enabling intense mixing and efficient reactions. The vigorous movement of the solid material in the fluidized bed reactor ensures uniform distribution and mixing of solid and gas, crucial for efficient chemical reactions.



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# STA L81

## STA L81/1

The highest resolution 0.01 µg balance for small sample quantities allows the detection of very small effects with highest accuracy.

## STA L81/2

The standard model (25 g) covers a broad application range with excellent resolution (0.02 µg) and accuracy.

## STA L81/3

The high mass variant allows measuring samples with big volumes or weight up to 35 g to determine even small effects within a large amount of inhomogeneous material.

TG - DSC/DTA  
+ Pressure



# Software

All LINSEIS thermo analytical instruments are software controlled. The individual software modules run exclusively under Microsoft® Windows® operating systems. The complete software consists of a data acquisition, data evaluation and administration module and incorporates all essentials: features for measurement preparation, execution and evaluation of a thermoanalytical measurement. Thanks to our specialists and application experts, LINSEIS was able to develop comprehensive, easy to understand, user friendly and application driven software.

## Features-Software:

- Data security in case of power failure
- Thermocouple break protection
- Repetition measurements with minimum parameter input
- Evaluation of current measurement
- Curve comparison of up to 50 curves
- Storage and export of evaluations
- Export and import in ASCII format
- Data export to MS Excel
- Multi-methods analysis (DSC, TG, TMA, DIL, etc.)
- Zoom function
- 1st and 2nd derivation
- Programmable gas control
- Curve arithmetics
- Statistical evaluation package
- Free scaling
- Automatic calibration
- Optional Kinetic and Lifetime Prediction
- Software packages
- Interface to MS and FTIR

## TG – Features:

- Mass change as % and mg
- Rate Controlled Mass Loss (RCML)
- Evaluation of mass loss
- Residue mass evaluation

## HDSC – Features:

- Glass transition temperature
- Complex peak evaluation
- Multipoint calibration for sample temperature
- Multipoint calibration for change of enthalpy
- Cp calibration for heat flow
- Signal-steered measuring procedures





The **LINSEIS Thermal Library** software package comes as an option for the well-known, user friendly LINSEIS LiEAP (Linseis Evaluation and Acquisition Platform) software that is integrated in almost all our instruments.

The Thermal Library allows the sample material identification by comparing the measurement curve with a data base providing thousands of references and standard materials within only 1-2 seconds.

### Multi-Instrument

LINSEIS instruments such as DSC, STA, TGA & LFA can be controlled with the same powerful LiEAP software platform.

### Multi-User

The administrator can generate different user levels providing different rights to operate the instrument. A optional Log file is also available.

### Report Generator

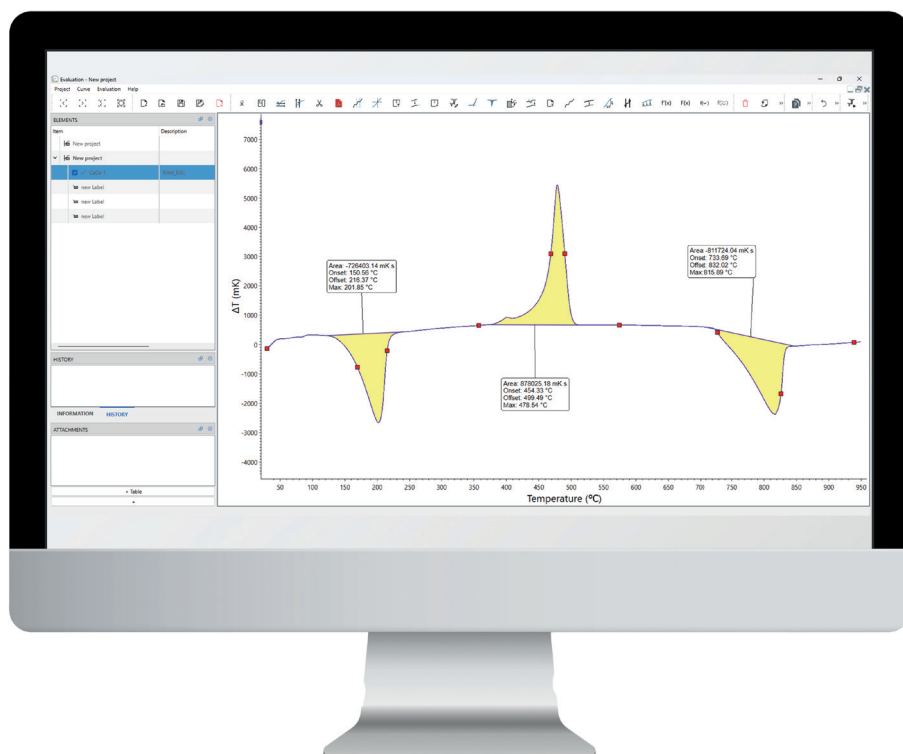
Convenient template selection to generate customized measurement reports.

### Database

State of the art database design enables easy data handling.

### Kinetic software

Kinetic analysis of DSC, DTA, TGA, EGA (TG-MS, TG-FTIR) data for the study of the thermal behavior of raw materials and products.



# Technical Specifications

	STA L81		
<b>Temperature range</b>	-150 °C up to 500 / 700 / 1000 °C RT up to 1000 / 1400 / 1600 / 1750 / 2000 / 2400 °C		
<b>Vacuum</b>	10 <sup>-5</sup> mbar (depends on vacuum pump)		
<b>Pressure</b>	up to 5 bar (optional)		
<b>Heating rate</b>	0.01 up to 100 K/min (depends on furnace) (from 0.001 °C/min on request)		
<b>Temperature precision</b>	0.001 °C		
<b>Sample robot</b>	optional 42		
<b>TG</b>	1	2	3
<b>Resolution</b>	0.01 µg	0.02 µg	0.1 µg
<b>Sample weight</b>	Balance can read weight automatically		
<b>Measuring range</b>	5 g / ± 2500 mg (mass change)	25 g / ± 2500 mg (mass change)	35 g / ± 20000 mg (mass change)
<b>DSC</b>			
<b>DSC-sensors</b>	E / K / S / B / C (C = DTA only)		
<b>DSC resolution</b>	0.3 / 0.4 / 1 / 1.2 µW		
<b>Calorimetric sensitivity</b>	approx. 4 / 6 / 17.6 / 22.5 µW		
<b>DTA</b>			
<b>DTA-resolution</b>	0.03 nV		
<b>Sensitivity</b>	1.5 µV/mW		
<b>DTA-measuring ranges</b>	250 / 2500 µV		



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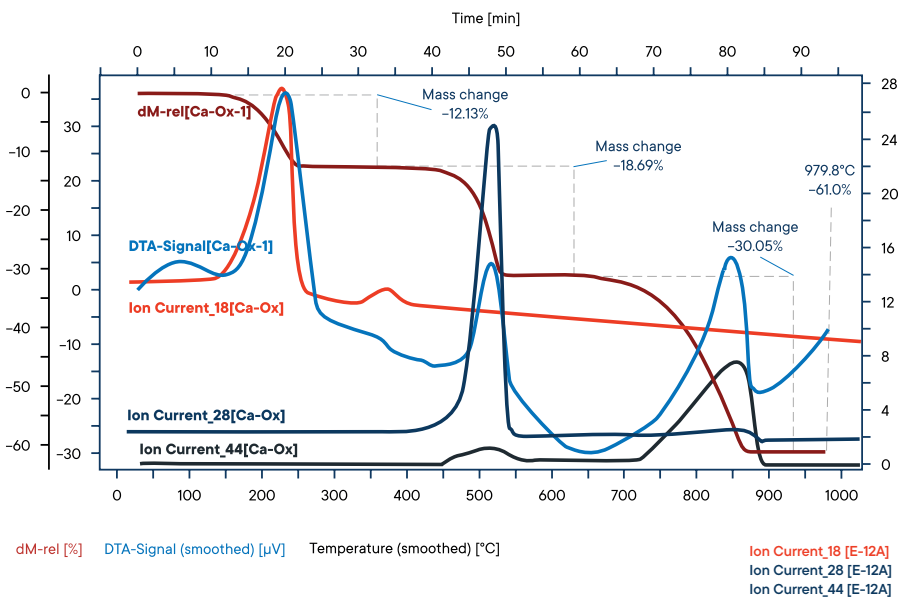
# Whining Carries

# Applications

STA Overview

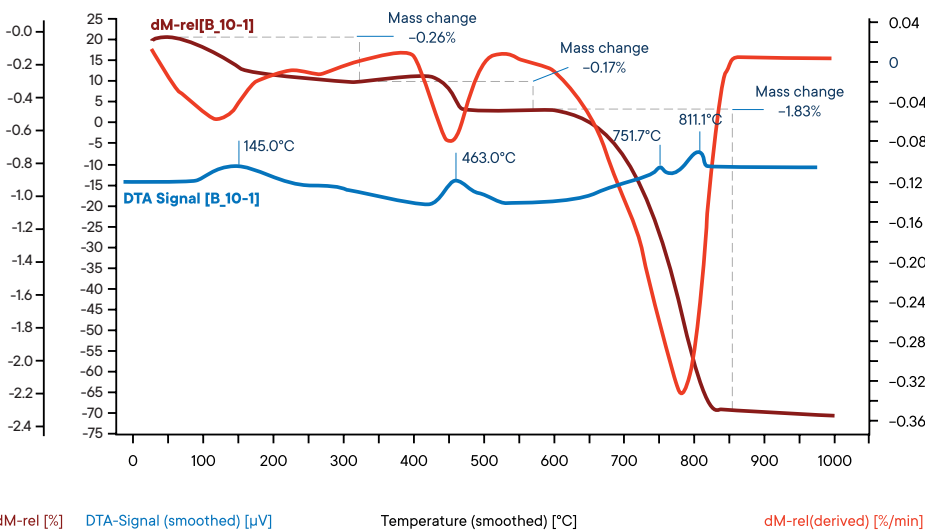


## Decomposition of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$



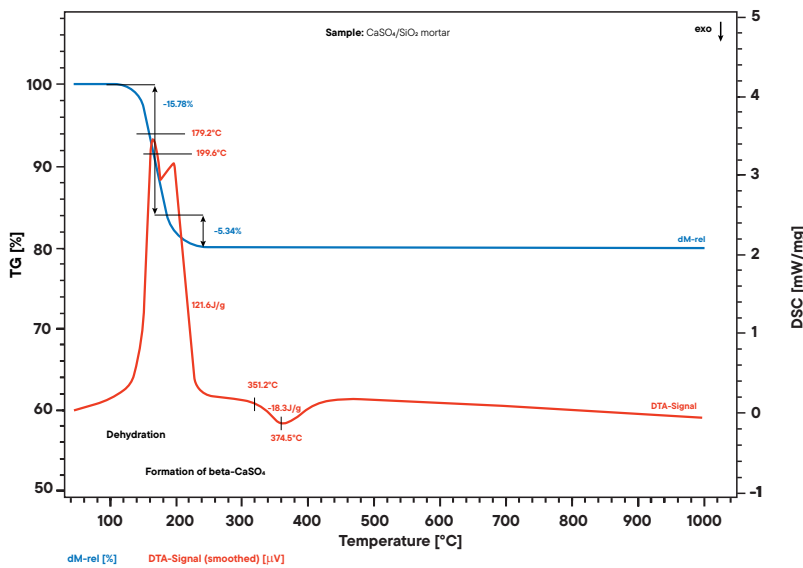
The evolved gases from the decomposition of calcium oxalate have been fed into the mass spectrometer with a heated capillary. The ion currents for mass numbers 18 (water), 28 (carbon monoxide) and 44 (carbon dioxide) have been imported into the graph.

## Cement



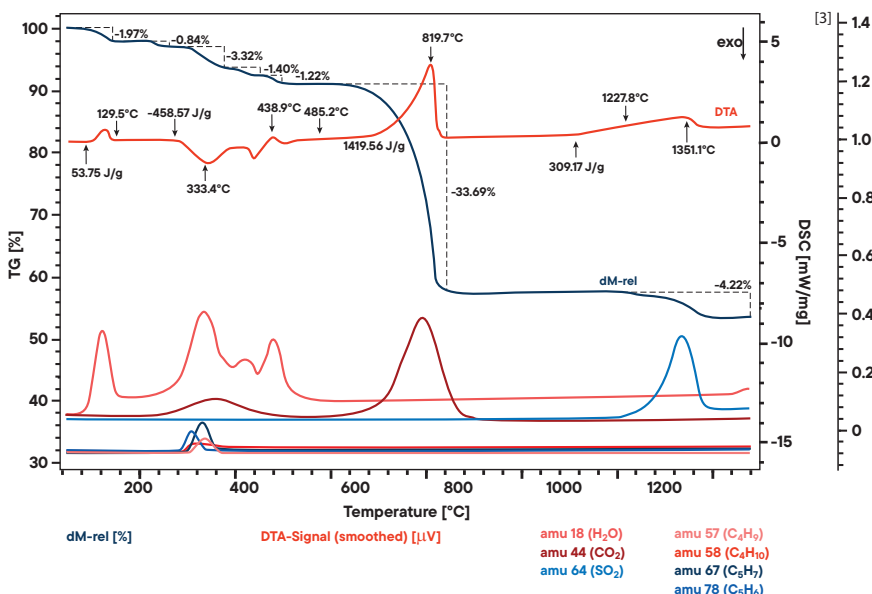
The main parts of cement are tri calcium silicate, di calcium silicate and tri calcium aluminates. Hydrates slowly form after mixing cement with water. The absorbed water evaporates first. Hydrates of the calcium silicate decompose at 570 °C. The hydroxides of calcium, magnesium and aluminum follow. Subsequently,  $\text{CO}_2$  splits off from calcium carbonate.

## Gypsum and Quartz



Mortar, made from gypsum and quartz sand, is used to bond bricks and fill holes in buildings. When mixed with water, it forms a paste that hardens into a stone-like material upon drying. This process and the final product can be analyzed through thermal techniques, including Simultaneous Thermal Analysis (STA), to study its decomposition and durability. These insights help understand the material's properties and its behavior under different thermal conditions.

## Thermal decomposition of cement



### Analysis using STA and QMS

This application shows STA measurement of cement with coupled MS. Mass spectrometry shows peaks from H<sub>2</sub>O at low temperatures most probably from gypsum. The DSC peaks and the signal from mass spectrometer between ~300°C – 400°C indicates the decomposition of organic components. The peak of CO<sub>2</sub> at ~800°C indicates the decomposition of CaCO<sub>3</sub>. At ~1300°C CaSO<sub>4</sub> decomposes (SO<sub>2</sub> – Peak).

# ***LINSEIS***

*pushing boundaries*

## **LINSEIS GmbH Germany**

Vielitzerstr. 43  
95100 Selb

Tel.: (+49) 9287 880 0  
E-mail: [info@linseis.de](mailto:info@linseis.de)

## **LINSEIS Inc. USA**

109 North Gold Drive  
Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070  
E-mail: [info@linseis.com](mailto:info@linseis.com)

## **LINSEIS China**

Kaige Scientific Park  
Room 120, Building T3, No.1220  
Yuqiao Road, Pudong, Shanghai

Tel.: (+86) 61 90 12 03  
Tel.: (+86) 50 55 06 42  
E-mail: [info@linseis.com.cn](mailto:info@linseis.com.cn)

## **LINSEIS India**

Plot 65, 2nd Floor, Sai Enclave,  
Sector 23, Dwarka05-800  
110077 New Delhi

Tel.: +91-11-42883851  
E-mail: [sales@linseis.in](mailto:sales@linseis.in)



[WWW.LINSEIS.COM](http://WWW.LINSEIS.COM)

**LINSEIS**

*pushing boundaries*

**STA L82**

Simultaneous  
**Thermal  
Analysis**



WWW.LINSEIS.COM



Since 1957 LINSEIS Corporation has been delivering outstanding service, know-how and leading innovative products in the field of thermal analysis and thermo-physical properties.

Customer satisfaction, innovation, flexibility, and high quality are what LINSEIS represents. Thanks to these fundamentals, our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermoanalytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials, and environmental analytics. In addition, thermophysical properties of solids, liquids, and melts can be analyzed.

Rooted in a strong family tradition, LINSEIS is proudly steered into its third generation, maintaining its core values and commitment to excellence, which have been passed down through the family leadership. This generational continuity strengthens our dedication to innovation and quality, embodying the essence of a true family-run business.

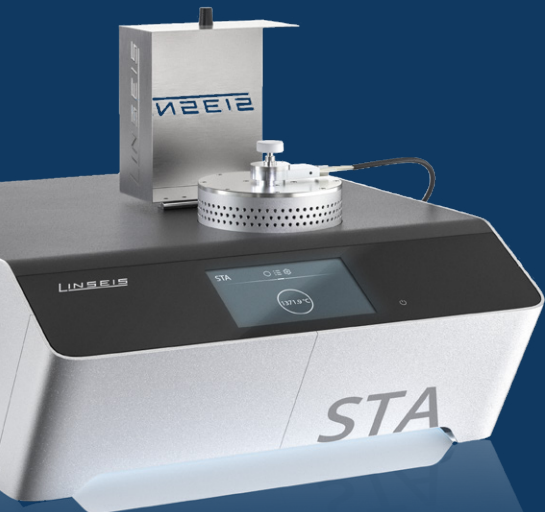
LINSEIS provides technological leadership. We develop and manufacture thermoanalytic and thermophysical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal analysis equipment.

The development of thermoanalytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

C L A U S   L I N S E I S  
C E O   D I P L .   P H Y S .

To strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is to constantly develop new technologies to enable continued discovery in Science.



# Engineering & Innovation

# Linseis Service



## Customized Solutions - The Linseis Advantage

At Linseis, we believe that every measurement challenge is unique — and so should be your instrument.

While many suppliers rely on standardized configurations, Linseis distinguishes itself through exceptional flexibility and the capability to deliver customer-specific adaptations in record time.

Our experienced engineering teams work hand in hand with you to design and implement fully customized solutions that meet your precise application requirements — whether that means a unique sensor configuration, an extended temperature range, or a specialized software integration.

With decades of experience and a modular product architecture, we turn customization into a standard service — fast, efficient, and reliable.

Choose Linseis and experience what true flexibility in thermal analysis and material characterization means.

Contact form





Service & Support

## Redefining Ownership

When investing in analytical instrumentation, long-term value matters just as much as precision. That's why Linseis systems are engineered to deliver the lowest Total Cost of Ownership in their class — combining reliability, efficiency, and flexibility in every detail.

Our instruments are built with robust, high-quality components designed for longevity and minimal maintenance. This means fewer service interventions, shorter downtimes, and reduced operating costs over the entire product lifetime. Intelligent software updates and remote support further ensure that your system remains state-of-the-art, even years after installation.



# Simultaneous Thermal Analysis

Simultaneous TGA-DTA/DSC measures both, **heat flow** and **weight change** of a sample as a function of temperature or time under controlled atmosphere. Simultaneous measurement of these two material properties not only improves productivity but also simplifies interpretation of the results. The complimentary information obtained allows differentiation between endothermic and exothermic events which have no associated weight change (e.g., melting and crystallization) and those which involve a weight change (e.g., degradation).

## STA

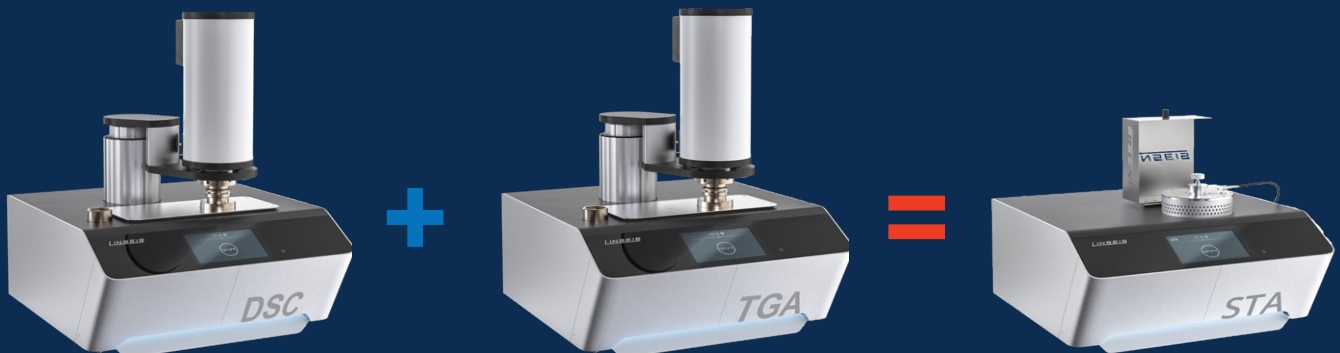
(Simultaneous Thermal Analysis)

## DSC

(Differential Scanning Calorimeter)

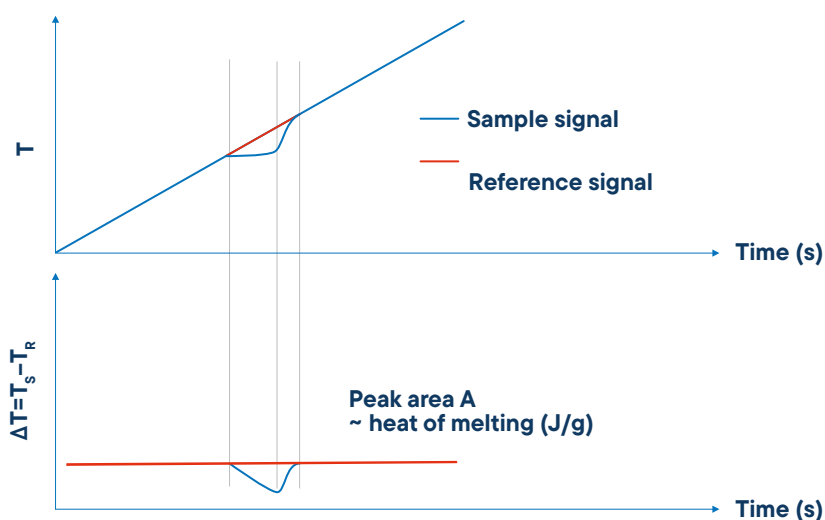
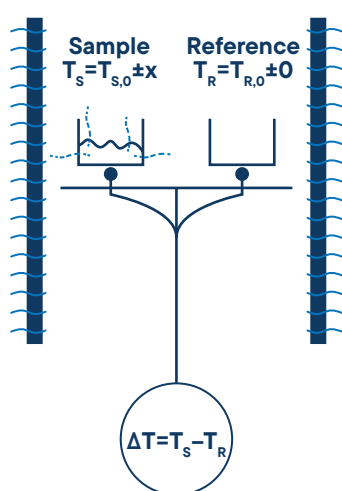
## TGA

(Thermogravimetric analyzer)



# DSC-True Heat Flow measurement

## Quantitative DSC-signal



### Differential Scanning Calorimetry (DSC)

A technique in which the difference in energy input into a substance and a reference material is measured as a function of temperature, while the substance and reference material are subjected to a controlled temperature program.

### Differential Signal

The differential signal is displayed as a baseline. Effects, for example the melting of a metal, can be observed as a peak. The area of the peak gives the amount of enthalpy and the direction of the peak indicates the way of heat flux – endothermic (down) or exothermic (up).

### Temperature vs. Time

During an effect like a reaction, decomposition or phase transition, a temperature difference (heat flux difference) between the sample and the reference crucible can be measured by means of a thermocouple.

### Measurable Properties

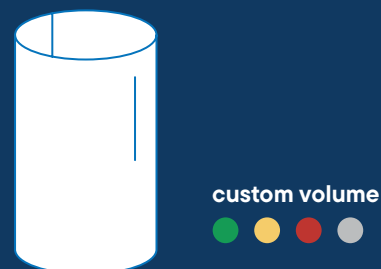
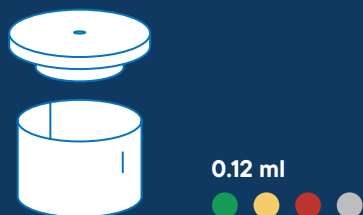
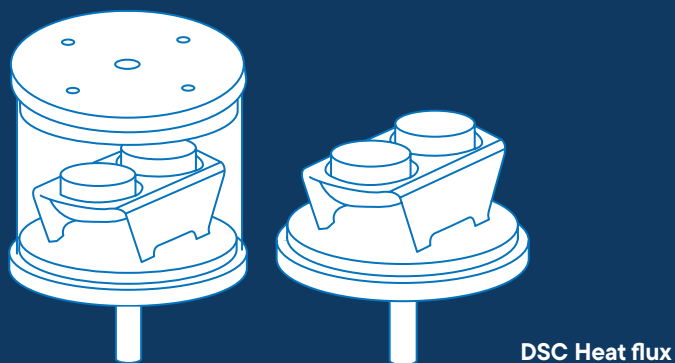
- Mass change in % and mg
- Rate controlled mass loss
- Evaluation of mass loss
- Residue mass evaluation
- Compositional analysis
- Enthalpy
- Endo- / exothermic reaction
- Phase transition
- Melting point
- Glass point
- Crystallinity
- Thermal stability
- Oxidation stability
- Purity
- Solidus / Liquidus relationship
- Product identification

# Measurement Systems & Crucibles

The Linseis STA can be equipped with an unmatched amount of different user exchangeable TG-DSC, TG-DTA or TG sensors. Each sensor is available with different thermocouples to provide the highest sensitivity for the desired temperature range and application. Additionally, there are multiple crucible types available that enables the user to find the matching combination for his application.

- Al<sub>2</sub>O<sub>3</sub>
- Platinum
- Aluminium
- others

## TG-DSC

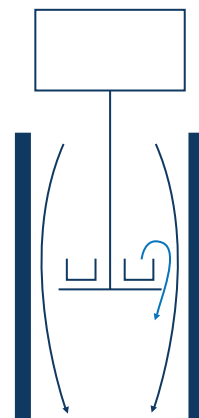
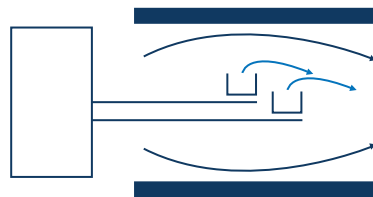
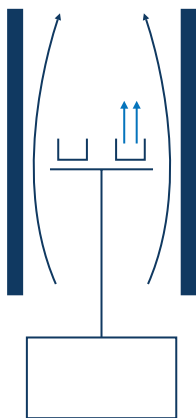




# Benefits of the vertical top loading design

The vertical “sample on top” design of the LINSEIS thermo-balance provides highest possible accuracy due to a stable position of the sample and easy sample handling.

TGA/ STA PT 1000/1600



## Vertical system (sample on top) LINSEIS configuration

### Advantages:

- Easy sample handling
- Easy exchange of sample holder
- Stable position of the sample in the furnace  
(critical for good DTA/DSC and Cp results)

### Disadvantage:

- Complicated construction

## Horizontal system

### Advantages:

- Small buoyancy effects

### Disadvantages:

- Very difficult sensor exchange
- Difficult sample handling
- Very high purge gas rate required
- Problems due to sensor expansion during heating/cooling

## Vertical system (sample on bottom)

### Advantage:

- Stable position within furnace

### Disadvantages:

- Difficult sensor exchange
- “Dangerous” gas flow within balance housing (sample gets blown out)
- Sensor position depends on sample weight

# STA L82

The STA L82 has been optimized for the analysis of materials in a temperature range up to 1100°C, which mainly includes organic materials. The LINSEIS HiRes option allows analyzing mass change effects with highest possible accuracy by effective trigger heating rate changes. The software can detect a mass change due to oxidation or decomposition and can automatically adjust the heating rate or stop heating. After the mass change is over, the system continues heating according to the set profile. This allows a better separation of effects that are taking place shortly after each other or almost similar. The LINSEIS STA L82 is a high-precision thermal analyzer for simultaneous thermal analysis (STA), combining thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) in one device. Its integrated furnace control enables precise heating with minimal overshoot, making it ideal for diverse applications in material characterization for research and quality control.

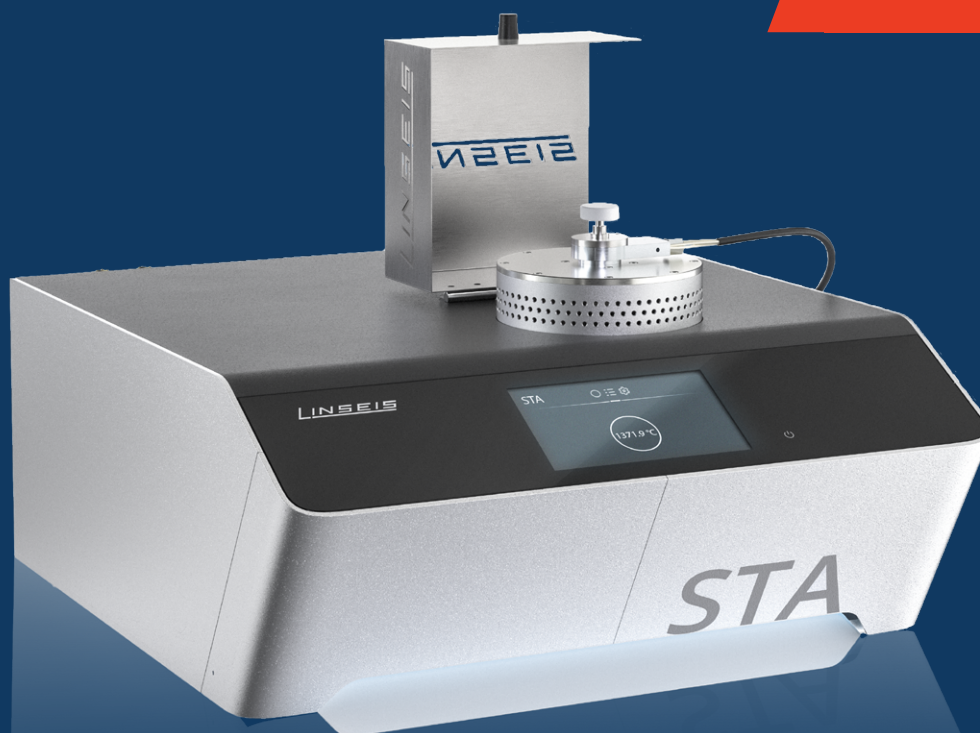
## Design

Build in furnace and gas control with low thermal mass for unmatched heating and cooling rates.

## Sample robot

Optional 90 position sample robot is available.

**New vacuum tight furnace for coupling**





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# New features

## Electronic Upgrade

The new measuring electronics offer significant performance improvements, inspired by the architecture of the „Linseis Digital Balance“. The benefits of this new digital balance architecture include:

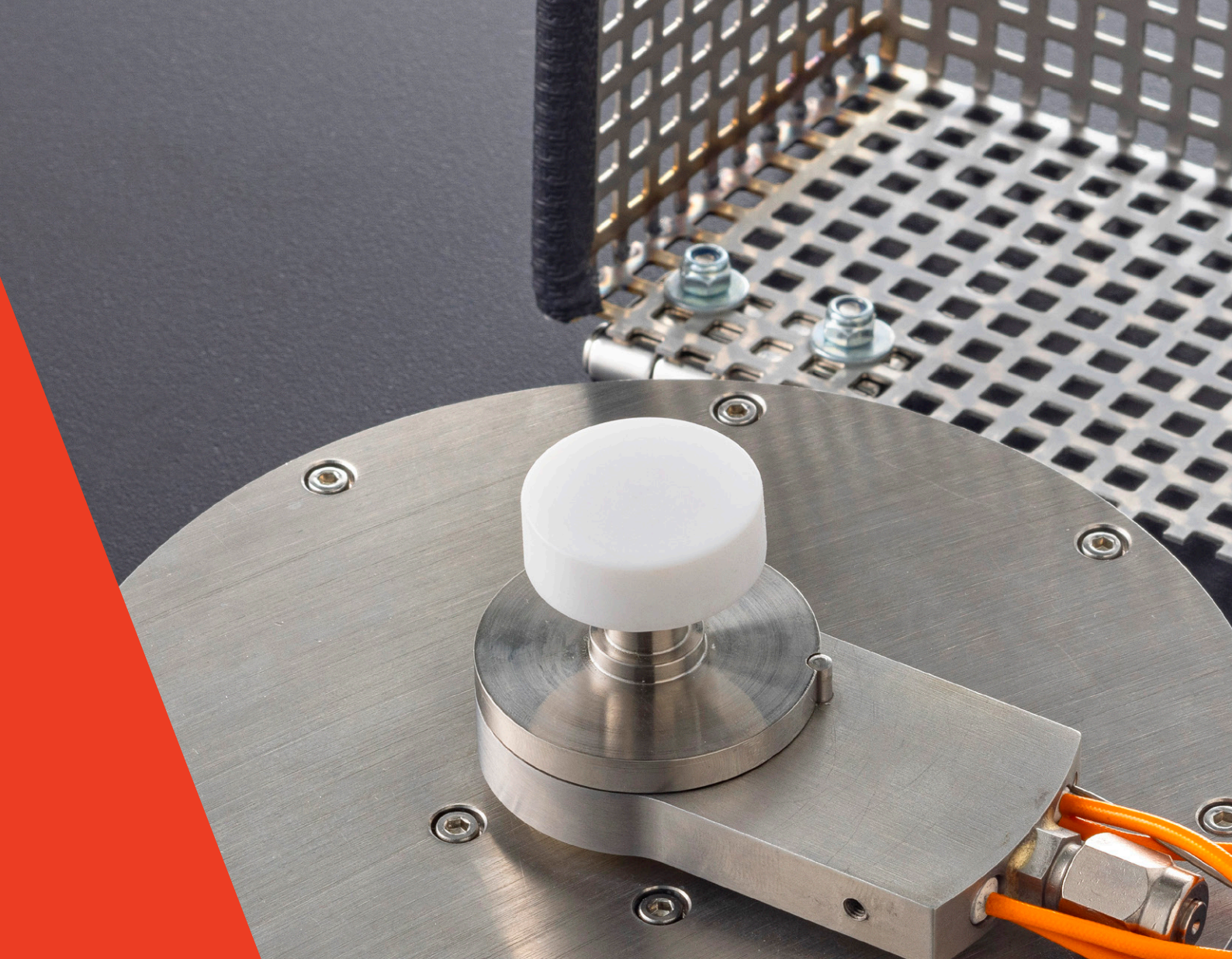
- **Minimization of drift:** Ensures consistently high precision over long periods of time.
- **Improved resolution:** Unique sub-microgram resolution.
- **Highest accuracy:** Improves the reliability of your measurement results.
- **Reproducibility:** Ensures consistent results with repeated measurements.

## Linseis Lab Link

With Linseis Lab Link, we offer an integrated solution to address uncertainties in measurement results. With direct access to our application experts via the software, you can get advice on the correct measurement procedure and evaluation of results. This direct communication ensures optimal results and maximizes the efficiency of your measurements for precise analysis and research as well as a smooth process flow.

## Software Improvements

- **Lex Bus Plug & Play:** Our latest hardware interface Lex Bus revolutionizes the way data communicates within our systems. Lex Bus enables seamless and efficient integration of new hardware and software tools.
- **Improved furnace control:** Our new and further improved furnace control offers a faster heating and cooling as well as more precise temperature control, which leads to better measurement results through better temperature sequencing according to your wishes and requirements.
- **New software with user interface:** Our communication is now even more focused on the needs of our customers to ensure that you are always informed of the latest status and receive support whenever it is needed.
- **Process security:** We have optimized our software for process security to ensure that your data is protected at all times and processed in a fail-safe manner.
- **Error messages and bug fixes:** Our system automatically detects errors and bugs, which are immediately documented and fixed to minimize downtime.
- **Automatic updates and new features:** Our software receives regular automatic updates that not only improve security, but also continuously provide new features.
- **Permanent system monitoring:** Our software constantly monitors the system parameters to ensure optimum performance.
- **Preventive maintenance and problem detection:** Our preventive maintenance approach detects problems and wear and tear before they can cause damage and keeps your device in top shape.



## Design Improvements

The new device design is characterized by an elegant aluminum casing that is both robust and aesthetically pleasing. The LED status bar provides a user-friendly visualization of important information. A touch panel enables intuitive operation and contributes to a modern user experience that combines comfort and functionality. The new device design focuses on ergonomic operation.

## New Hardware Features

- **Tri-couple DTA measuring system:** DTA measuring system with three thermocouples for the smallest endo-/exothermic effects in inhomogeneous samples
- **Jacketed DTA measuring system:** For corrosive samples
- **Patented „forced flow“ method:** Enables forced flow through your TG or TG-DTA. Our system enables forced flow through the sample, where by up to 100 % reaction gas is fed directly to the sample. This novel method enables scalable measurements for the first time, allowing precise analysis under real conditions.

# Unique features

## Automatic Evacuation

The devices feature a built-in automatic evacuation capability, ensuring efficient processes and smooth operation.

## Vacuum and controlled atmosphere

- Supports high vacuum, inert, reducing, oxidizing, or humidified atmospheres
- Optional pressurization up to 5 bar overpressure
- Analysis of certain corrosive conditions with precautions
- Adaptability for residual gas analysis with optional heated capillary

## Evolved gas analysis

Optional gas analysis with MS, FTIR, or GCMS is possible, providing valuable additional information. The system can be configured with standalone and integrated MFC for gas dosing. Additionally, customer-specific options such as a heated inlet can also be integrated into the device.

## Gas safety system

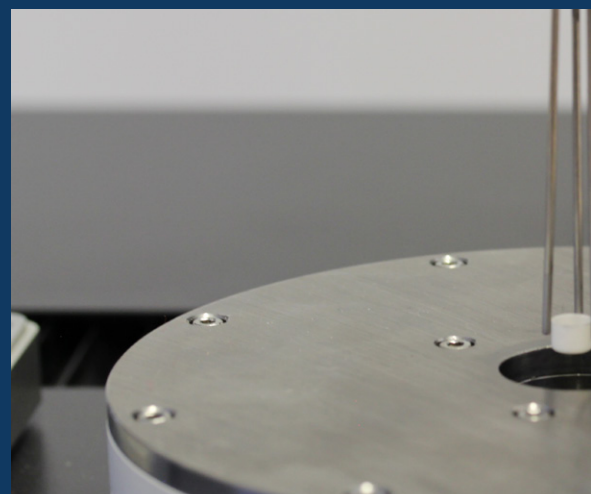
The gas safety system is designed to accommodate various gases such as hydrogen or carbon dioxide, ensuring secure operation and user safety.

## Controlled humidity and water vapour

The device can regulate the humidity and water vapour during the measurement.

## Sample robot

Our STA L82 can be equipped with a proven sample robot for unattended sample measurements for highest throughput.



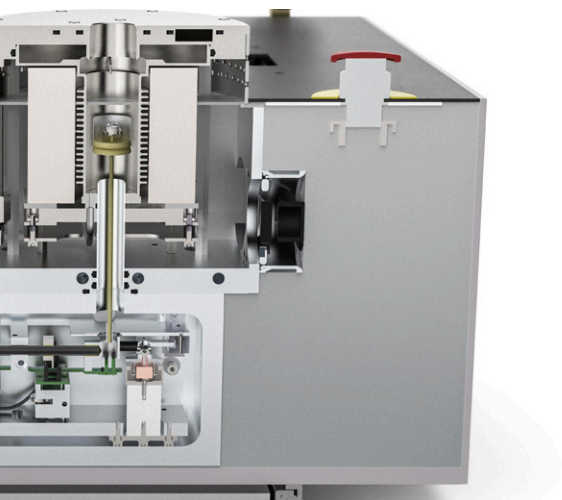


### **Automatic calibration**

We offer an automatic calibration function in the software and hardware. With this function, our STA automatically calculates a calibration factor, which is also displayed.

### **Integrated LINSEIS platform**

The integrated LINSEIS software offers a comprehensive solution, combining both hardware and software for maximum process security and precision. By providing a unified platform, it ensures seamless integration of components and devices from external partners, resulting in a highly robust system.



### **Customization**

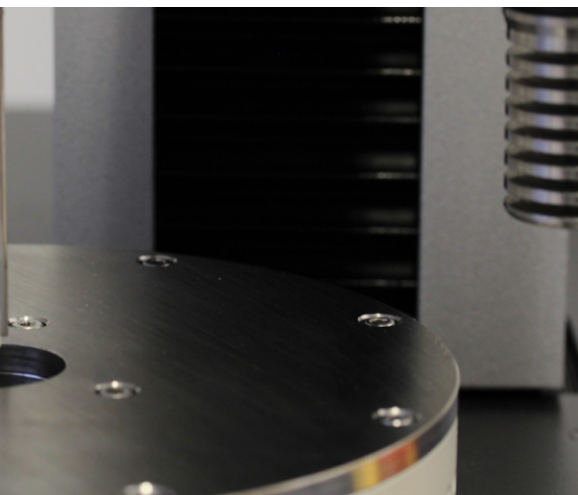
Close collaboration with the customers to tailor unique solutions, leveraging LINSEIS expertise to meet their specific needs.

### **Service**

Our international presence across every continent enables us to deliver the best and fastest service possible.

### **Accessories starter kit**

The accessory starter kit guarantees fast and uncomplicated usage, serving as a complete system for instant application specific needs.





## Equipment for gas control and safety (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)

All Linseis instruments can be prepared for the use in hydrogen atmosphere with just minor adjustments. The most important thing is a safety system that can ensure that there is no leakage and no explosive atmosphere generated outside of the instrument. Therefore, the Linseis safety system uses hydrogen sensors that are coupled to an automatic gas control panel. If there is a leakage or unwanted hydrogen release, the instrument is automatically flooded with inert gas and the hydrogen valves are closed. This ensures a minimum risk level during operation. Besides that, the system contains an optional burn off unit where the gas outlet is connected to, to ensure that also the used gas of the measurement chamber is not just released into the environment. The system can also be operated with several combinations of inert gases and even water vapor besides hydrogen.

### In summary, the Linseis safety system comes with the following benefits:

- Automatic evacuation function
- Gas flow control for multiple gases including water vapor and hydrogen
- Emergency shutdown function
- Gas detector system (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)
- optional burn off unit
- Continuous monitoring to ensure safe operating conditions



Fig. 1

# Linseis equipment for operation under water vapor and controlled relative humidity



For many applications in thermal analysis, the atmosphere plays an important role as it may affect the sample behavior or activate reactions. Humidity influence on building materials, storage time of pharmaceuticals and foods or influence on mechanical properties of polymers are just some of the most common examples. Of course, the Linseis instruments are suitable for such experiments, however there is one fact that is often causing confusion and must be considered carefully: The difference between water vapor and relative humidity.

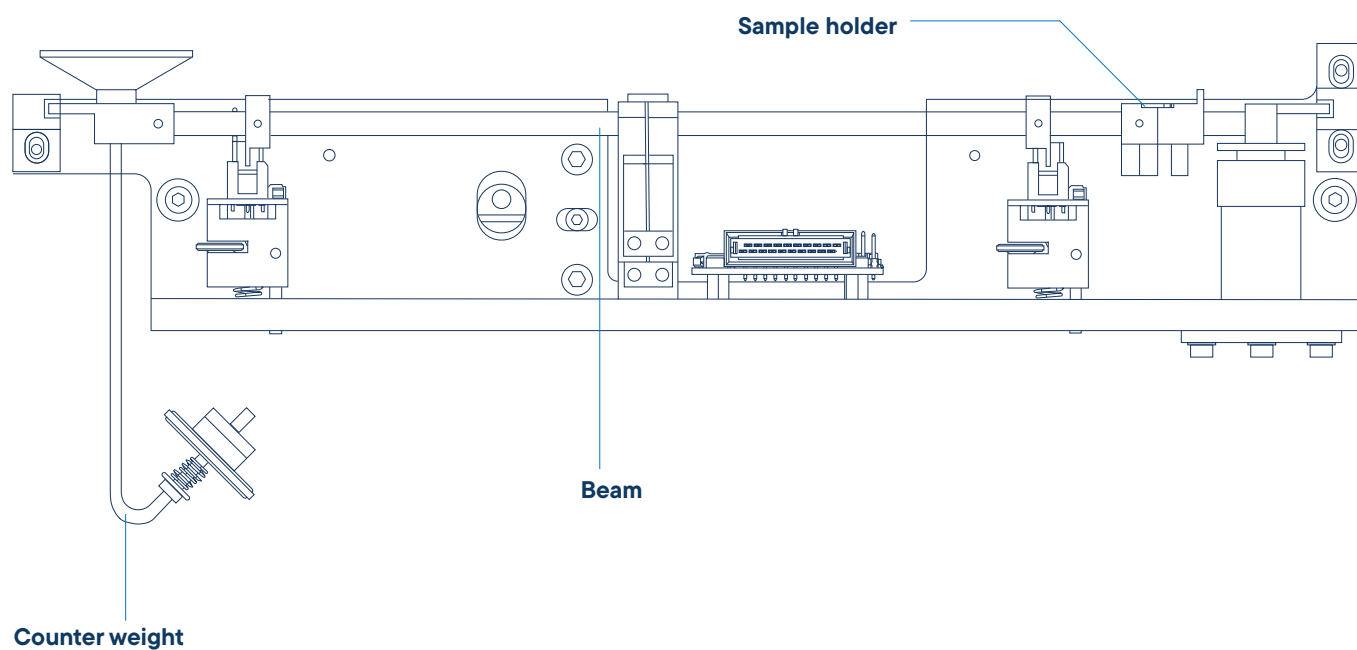
Relative Humidity Generators are most commonly used for experiments around room temperature, while water vapor applications are most often at higher temperatures. When water is heated to its boiling point or higher than that, the water changes its aggregate form from liquid to gaseous. It is then existing as water vapor (steam). If this steam is introduced into any kind of reaction chamber or instrument, it is called water vapor application. In contrast, every gas can transport and contain a certain amount of water at a given temperature. This is called humidity. Considering air as an example, there is always an amount of water contained in the air, even below the boiling point of water, which is defined as grade of humidity or relative humidity.

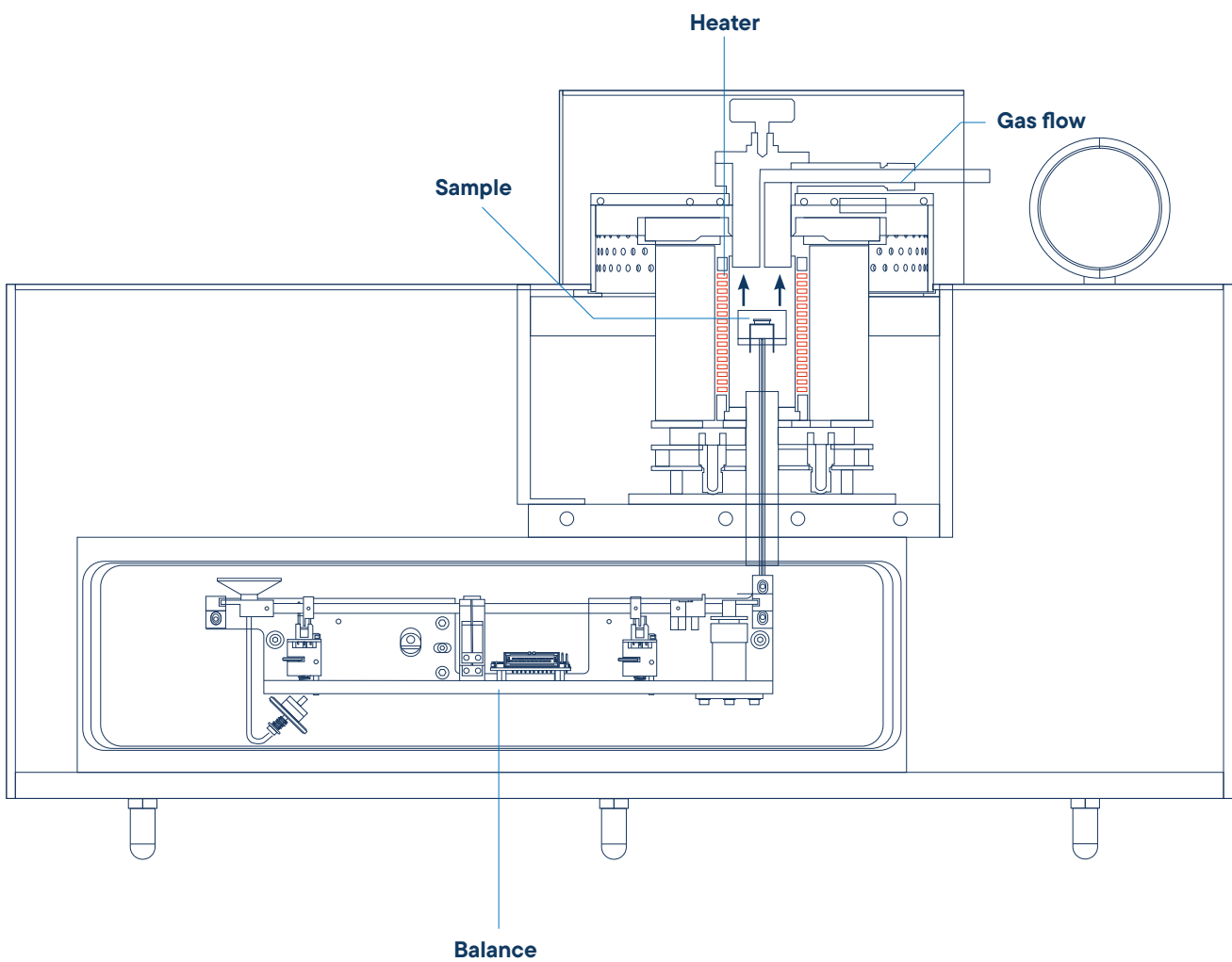


## Highest precision beam balance

Our different microbalances are specifically designed to accomplish thermal analysis tasks in the best possible way, providing ultra light weight design to follow fast weight changes and symmetric construction for ultra low drift long term measurements.

Linseis micro balance  
especially designed for  
thermal  
analysis instruments





### Advantages of LINSEIS balance design

- Sample mass compensation by a counterweight enables improved sensitivity
- Improve symmetrical design for high interference levels
- Not affected by local gravity
- Not affected by thermal fluctuations

- Highest possible PRECISION
- Concept enables easy maintenance
- Depending on model, balance can handle from mg up to 50 g sample mass

### Advantages of combined TG+DSC

- Same geometry
- Stoichiometry
- Same temperature profile
- Same atmosphere
- Same humidity



The **LINSEIS Thermal Library** software package comes as an option for the well-known, user friendly LINSEIS LiEAP (Linseis Evaluation and Acquisition Platform) software that is integrated in almost all our instruments.

The Thermal Library allows the sample material identification by comparing the measurement curve with a data base providing thousands of references and standard materials within only 1-2 seconds.

### Multi-Instrument

LINSEIS instruments such as DSC, STA, TGA & LFA can be controlled with the same powerful LiEAP software platform.

### Report Generator

Convenient template selection to generate customized measurement reports.

### Kinetic software

Kinetic analysis of DSC, DTA, TGA, EGA (TG-MS, TG-FTIR) data for the study of the thermal behavior of raw materials and products.

### Multi-User

The administrator can generate different user levels providing different rights to operate the instrument. A optional Log file is also available.

### Database

State of the art database design enables easy data handling.



# Software

All LINSEIS thermo analytical instruments are software controlled. The individual software modules run exclusively under Microsoft® Windows® operating systems. The complete software consists of a data acquisition, data evaluation and administration module and incorporates all essentials: features for measurement preparation, execution and evaluation of a thermoanalytical measurement. Thanks to our specialists and application experts, LINSEIS was able to develop comprehensive, easy to understand, user friendly and application driven software.

## Features-Software:

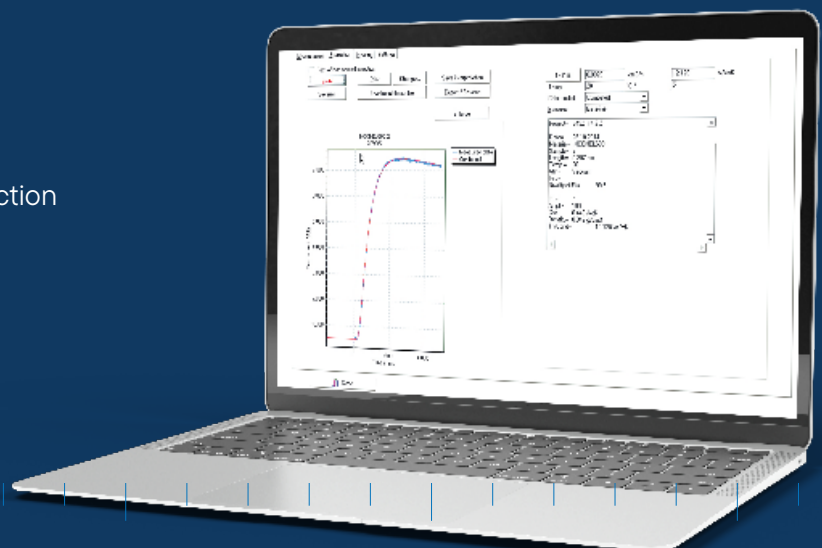
- Data security in case of power failure
- Thermocouple break protection
- Repetition measurements with minimum parameter input
- Evaluation of current measurement
- Curve comparison of up to 50 curves
- Storage and export of evaluations
- Export and import in ASCII format
- Data export to MS Excel
- Multi-methods analysis (DSC, TG, TMA, DIL, etc.)
- Zoom function
- 1st and 2nd derivation
- Programmable gas control
- Curve arithmetics
- Statistical evaluation package
- Free scaling
- Automatic calibration
- Optional Kinetic and Lifetime Prediction
- Software packages
- Interface to MS and FTIR

## TG – Features:

- Mass change as % and mg
- Rate Controlled Mass Loss (RCML)
- Evaluation of mass loss
- Residue mass evaluation

## HDSC – Features:

- Glass transition temperature
- Complex peak evaluation
- Multipoint calibration for sample temperature
- Multipoint calibration for change of enthalpy
- Cp calibration for heat flow
- Signal-steered measuring procedures





*push  
bound*



# Whining Carries

# Technical Specifications

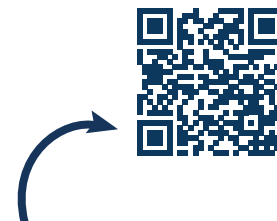


Product Overview



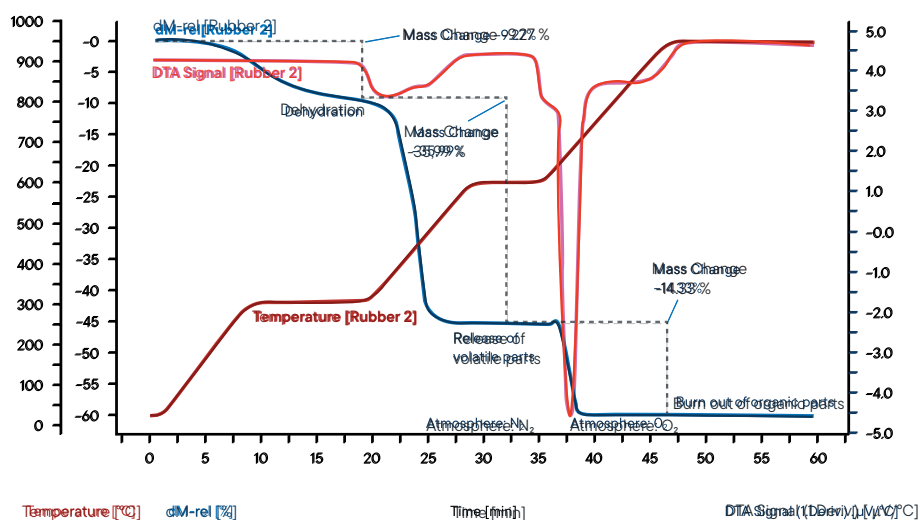
	STA L82
<b>Temperature range</b>	RT up to 1100 °C
<b>Vacuum</b>	optional 10 <sup>-2</sup> mbar
<b>Heating rate</b>	0.01 up to 100 K/min
<b>Temperature precision</b>	0.001 °C
<b>Sample robot</b>	optional 42/90
<b>TG</b>	
<b>Resolution</b>	0.1 µg
<b>Sample weight</b>	Balance can read weight automatically
<b>Measuring range</b>	25 / 2500 mg
<b>DSC</b>	
<b>DSC-sensors</b>	E / K / S / B / C (C = DTA only)
<b>DSC resolution</b>	0.3 / 0.4 / 1 / 1.2 µW
<b>Calorimetric sensitivity</b>	approx. 4 / 6 / 17.6 µW
<b>DTA</b>	
<b>DTA-resolution</b>	0.03 nV
<b>Sensitivity</b>	1.5 µV/mW
<b>DTA-measuring ranges</b>	250 / 2500 µV

# Applications STA L82



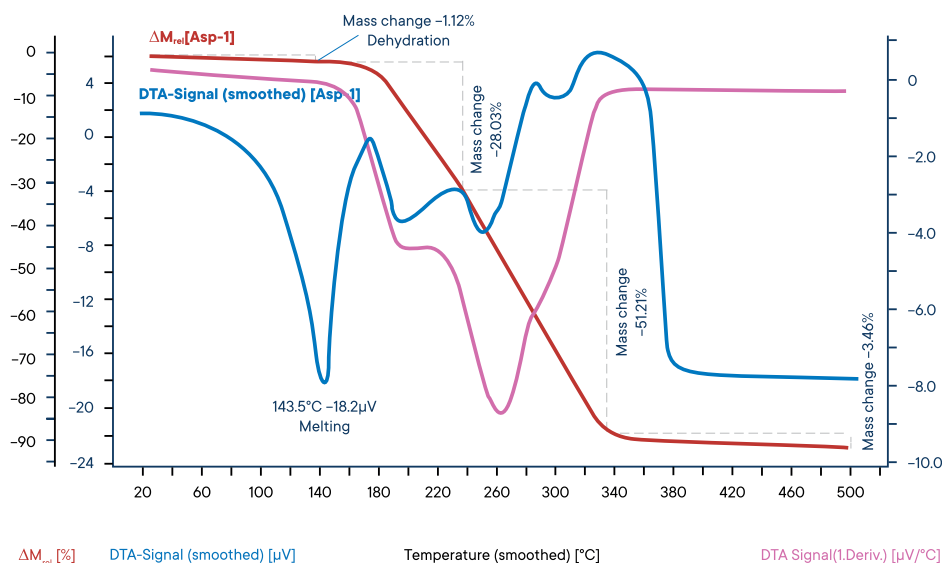
LINSEIS contract testing

## Decomposition of rubber



The measurement of an industrial rubber sample was conducted using a simultaneous thermal analyzer (STA L82) in a nitrogen atmosphere. The sample was heated in three steps at a rate of 30 K/min each. The blue curve shows the relative weight loss. In the first step, dehydration of the sample occurs, releasing 9.3% water, with no effect observed on the corresponding DTA signal (purple curve). In the second reaction step, volatile components (36.0%) are released by pyrolysis under nitrogen, identified by an exothermic peak on the DTA curve. In the third step, the atmosphere changes to oxygen, leading to the combustion of the remaining carbon, resulting in a 14.3% weight loss. The remaining 40.4% consists of inorganic components like ash, lime, or fillers.

## Aspirin



In this application acetylsalicylic acid (Aspirin) was measured by STA L82 with focus on the DSC-signal. By DSC, decomposition reactions can be observed and substances such as pharmaceuticals compounds can be investigated and identified. The measured ASS sample shows the following effects: At the beginning of the heating process, some adsorbed water is released, resulting in a weight loss of about 1%. At 140°C the melting point of the aspirin is reached, resulting in an endothermic reaction, measured on the DTA trace. At 60°C, decomposition of the molten drug takes place in several stages.

The decomposition products are volatile, resulting in a total weight loss of almost 100%.

# ***LINSEIS***

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## **LINSEIS GmbH Germany**

Vielitzerstr. 43  
95100 Selb

Tel.: (+49) 9287 880 0  
E-mail: [info@linseis.de](mailto:info@linseis.de)

## **LINSEIS Inc. USA**

109 North Gold Drive  
Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070  
E-mail: [info@linseis.com](mailto:info@linseis.com)

## **LINSEIS China**

Kaige Scientific Park  
Room 120, Building T3, No.1220  
Yuqiao Road, Pudong, Shanghai

Tel.: (+86) 61 90 12 03  
Tel.: (+86) 50 55 06 42  
E-mail: [info@linseis.com.cn](mailto:info@linseis.com.cn)

## **LINSEIS India**

Plot 65, 2nd Floor, Sai Enclave,  
Sector 23, Dwarka05-800  
110077 New Delhi

Tel.: +91-11-42883851  
E-mail: [sales@linseis.in](mailto:sales@linseis.in)



[WWW.LINSEIS.COM](http://WWW.LINSEIS.COM)

***LINSEIS***

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**STA/TGA L86**

Simultaneous  
**Thermal  
Analysis**





Since 1957 LINSEIS Corporation has been delivering outstanding service, know-how and leading innovative products in the field of thermal analysis and thermo-physical properties.

Customer satisfaction, innovation, flexibility, and high quality are what LINSEIS represents. Thanks to these fundamentals, our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermoanalytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials, and environmental analytics. In addition, thermophysical properties of solids, liquids, and melts can be analyzed.

Rooted in a strong family tradition, LINSEIS is proudly steered into its third generation, maintaining its core values and commitment to excellence, which have been passed down through the family leadership. This generational continuity strengthens our dedication to innovation and quality, embodying the essence of a true family-run business.

LINSEIS provides technological leadership. We develop and manufacture thermoanalytical and thermophysical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal analysis equipment.

The development of thermoanalytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

C L A U S   L I N S E I S  
C E O   D I P L .   P H Y S .



To strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is to constantly develop new technologies to enable continued discovery in Science.



# Engineering & Innovation

# Simultaneous Thermal Analysis

Simultaneous TGA-DTA/DSC measures both, **heat flow** and **weight change** of a sample as a function of temperature or time under controlled atmosphere. Simultaneous measurement of these two material properties not only improves productivity but also simplifies interpretation of the results. The complimentary information obtained allows differentiation between endothermic and exothermic events which have no associated weight change (e.g., melting and crystallization) and those which involve a weight change (e.g., degradation).

## STA

(Simultaneous Thermal Analysis)

## DSC

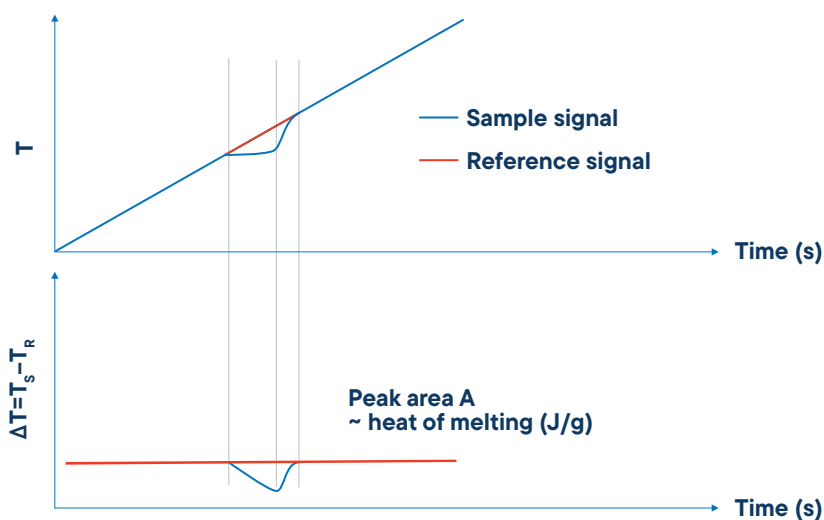
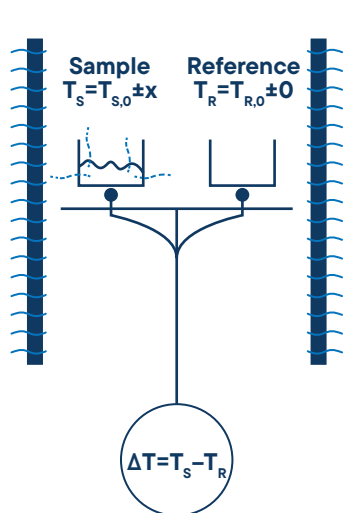
(Differential Scanning Calorimeter)

## TGA

(Thermogravimetry)

# DSC-True Heat Flow measurement

## Quantitative DSC-signal



### Differential Scanning Calorimetry (DSC)

A technique in which the difference in energy input into a substance and a reference material is measured as a function of temperature, while the substance and reference material are subjected to a controlled temperature program.

### Differential Signal

The differential signal is displayed as a baseline. Effects, for example the melting of a metal, can be observed as a peak. The area of the peak gives the amount of enthalpy and the direction of the peak indicates the way of heat flux – endothermic (down) or exothermic (up).

### Temperature vs. Time

During an effect like a reaction, decomposition or phase transition, a temperature difference (heat flux difference) between the sample and the reference crucible can be measured by means of a thermocouple.

### Measurable Properties

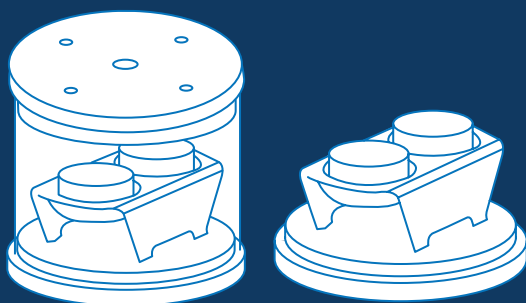
- Mass change in % and mg
- Rate controlled mass loss
- Evaluation of mass loss
- Residue mass evaluation
- Compositional analysis
- Enthalpy
- Endo- / exothermic reaction
- Phase transition
- Melting point
- Glass point
- Crystallinity
- Thermal stability
- Oxidation stability
- Purity
- Solidus / Liquidus relationship
- Product identification

# Sensors

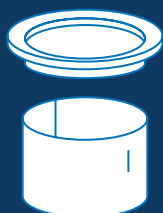
The Linseis STA/TGA L86 can be equipped with an unmatched amount of different user exchangeable TG-DSC, TG-DTA or TG sensors. Each sensor is available with different thermocouples to provide the highest sensitivity for the desired temperature range and application. Additionally, there are multiple crucible types available that enables the user to find the matching combination for his application.

## TG-DSC

- Al<sub>2</sub>O<sub>3</sub>
- Platinum
- Aluminium
- others



DSC Heat flux



0.12 ml



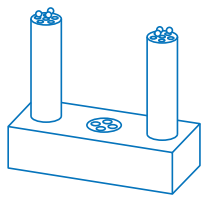
0.12 ml



custom volume

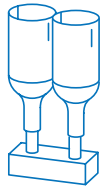


# TG-DTA



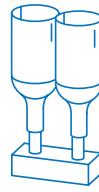
**NEW**

**Tri-couple Sensor**  
(three thermo couples)

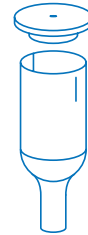


**NEW**

**Encapsulated DTA Sensor**  
(for corrosive gas)



**DTA-Sensor**



**Cap**

**0.3 ml or custom crucible volume**

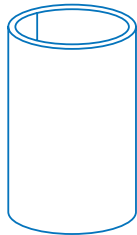
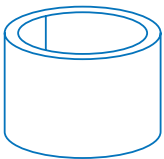
**Crucible**



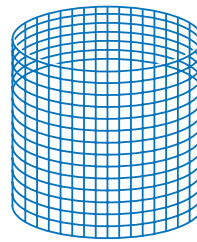
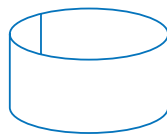
# TGA

costume volume

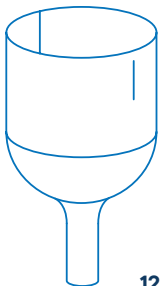
0.14 ml



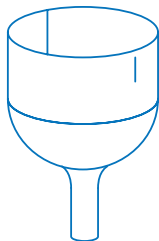
0.12 ml



**Mesh**



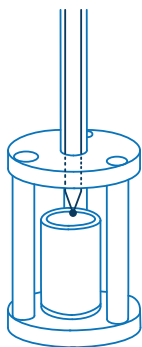
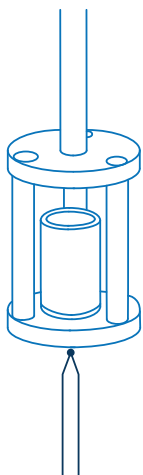
12.0 ml



5.0 ml



3.0 / 0.3 ml



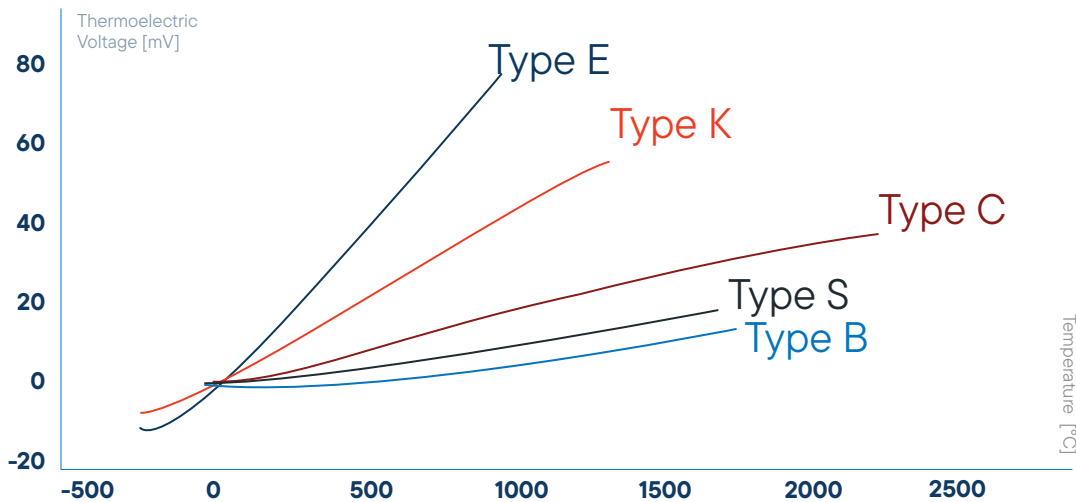
**TGA- Standard Sensors for one crucible**

Thermocouple adjustment depends on application



**Platinum wire-suspended crucible**

# Best possible sensitivity for every application



**Thermocouple types:**  
**Type E** (Chromel)  
 Constantan: -50 °C up to 900 °C  
**Type K** (Chromel)  
 Alumel: -180 °C up to 1100 °C  
**Type S** (Platinum-Rhodium/10 %)  
 Platinum: 0 °C up to 1600 °C  
**Type B** (Platinum-Rhodium/ 30 %)  
 Platinum-Rhodium (6 %): 25 °C up to 1800 °C  
**Type C** (Tungsten/5 %)  
 Rhenium: Tungsten (26 %)  
 Rhenium: 20 °C up to 2300 °C

All sensors available with the thermocouples illustrated. LINSEIS sensor combinations cover the broadest temperature range in the market (-180 °C up to 2400 °C).

## Furnace Programm

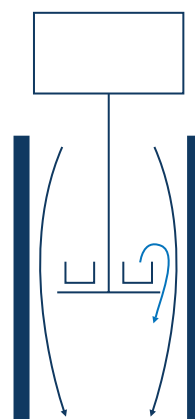
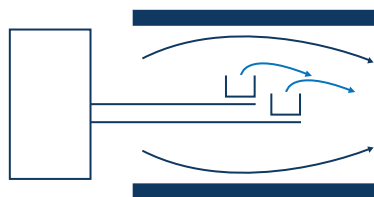
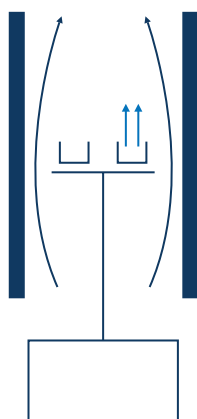
Temperature	Type	Element	Atmosphere	TC-Type
-70°C - 400°C	L86/264/RCF	HangDown only Intracooler / Kanthal	inert, oxid., red., vac.	K
-150°C - 500°C	L86/264/500	Kanthal	inert, oxid., red., vac.	K
-150°C - 700°C	L86/264/700	Kanthal	inert, oxid., red., vac.	K
-150°C - 1000°C	L86/264/1000	Kanthal	inert, oxid., red., vac.	K
RT - 1000°C	L86/220 AC	SiC	inert, oxid., red., vac.	K
RT - 1600°C	L86/240 AC	SiC	inert, oxid., red., vac.	S
RT - 1750°C	L86/250	MoSi <sub>2</sub>	inert, oxid., red., vac.	B
RT - 2000°C	L86/260/G/2000	Graphite	inert, red., vac.	C
RT - 2400°C	L86/260/G/2400	Graphite	inert, red., vac.*	Pyrometer
RT - 2800°C	L86/260/G/2800	Graphite	inert, red., vac.*	Pyrometer
RT - 2400°C	L86/260/T	Tungsten	inert, red.	C
RT - 1000°C	L86/200	Glow igniter	inert, oxid., red., vac.	S/K

\*Limited temperature range

# Benefits of the vertical top loading design

The vertical “sample on top” design of the LINSEIS thermo-balance provides highest possible accuracy due to a stable position of the sample and easy sample handling.

STA/TGA L86



## Vertical system (sample on top) LINSEIS configuration

### Advantages:

- Easy sample handling
- Easy exchange of sample holder
- Stable position of the sample in the furnace

(critical for good DTA/DSC and Cp results)

### Disadvantage:

- Complicated construction

## Horizontal system

### Advantages:

- Small buoyancy effects

### Disadvantages:

- Very difficult sensor exchange
- Difficult sample handling
- Very high purge gas rate required
- Problems due to sensor expansion during heating/cooling

## Vertical system (sample on bottom)

### Advantage:

- Stable position within furnace

### Disadvantages:

- Difficult sensor exchange
- “Dangerous” gas flow within balance housing (sample gets blown out)
- Sensor position depends on sample weight

Inno

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# New features

## Electronic Upgrade

The new measuring electronics offer significant performance improvements, inspired by the architecture of the „Linseis Digital Balance“. The benefits of this new digital balance architecture include:

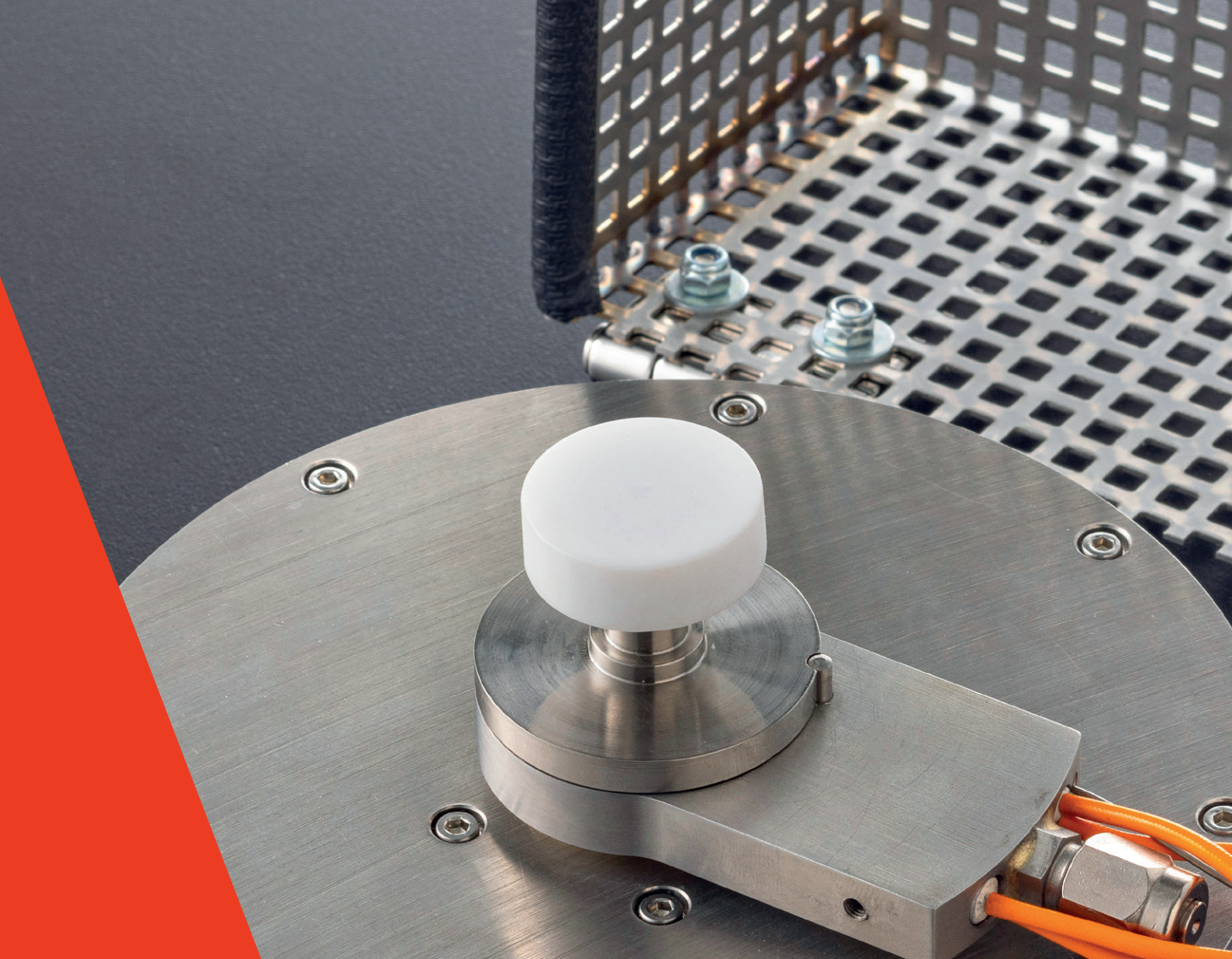
- **Minimization of drift:** Ensures consistently high precision over long periods of time.
- **Improved resolution:** Unique sub-microgram resolution.
- **Highest accuracy:** Improves the reliability of your measurement results.
- **Reproducibility:** Ensures consistent results with repeated measurements.

## Linseis Lab Link

With Linseis Lab Link, we offer an integrated solution to address uncertainties in measurement results. With direct access to our application experts via the software, you can get advice on the correct measurement procedure and evaluation of results. This direct communication ensures optimal results and maximizes the efficiency of your measurements for precise analysis and research as well as a smooth process flow.

## Software Improvements

- **Lex Bus Plug & Play:** Our latest hardware interface Lex Bus revolutionizes the way data communicates within our systems. Lex Bus enables seamless and efficient integration of new hardware and software tools.
- **Improved furnace control:** Our new and further improved furnace control offers a faster heating and cooling as well as more precise temperature control, which leads to better measurement results through better temperature sequencing according to your wishes and requirements.
- **New software with user interface:** Our communication is now even more focused on the needs of our customers to ensure that you are always informed of the latest status and receive support whenever it is needed.
- **Process security:** We have optimized our software for process security to ensure that your data is protected at all times and processed in a fail-safe manner.
- **Error messages and bug fixes:** Our system automatically detects errors and bugs, which are immediately documented and fixed to minimize downtime.
- **Automatic updates and new features:** Our software receives regular automatic updates that not only improve security, but also continuously provide new features.
- **Permanent system monitoring:** Our software constantly monitors the system parameters to ensure optimum performance.
- **Preventive maintenance and problem detection:** Our preventive maintenance approach detects problems and wear and tear before they can cause damage and keeps your device in top shape.



## Design Improvements

The new device design is characterized by an elegant aluminum casing that is both robust and aesthetically pleasing. The LED status bar provides a user-friendly visualization of important information. A touch panel enables intuitive operation and contributes to a modern user experience that combines comfort and functionality. The new device design focuses on ergonomic operation.

## New Hardware Features

- **Tri-couple DTA measuring system:** DTA measuring system with three thermocouples for the smallest endo-/exothermic effects in inhomogeneous samples
- **Jacketed DTA measuring system:** For corrosive samples
- **Patented „forced flow“ method:** Enables forced flow through your TG or TG-DTA. Our system enables forced flow through the sample, where by up to 100 % reaction gas is fed directly to the sample. This novel method enables scalable measurements for the first time, allowing precise analysis under real conditions.

# Unique features

## Automatic Evacuation

The devices feature a built-in automatic evacuation capability, ensuring efficient processes and smooth operation.

## Vacuum and controlled atmosphere

- Supports high vacuum, inert, reducing, oxidizing, or humidified atmospheres
- Optional pressurization up to 5 bar overpressure
- Analysis of certain corrosive conditions with precautions
- Adaptability for residual gas analysis with optional heated capillary

## Evolved gas analysis

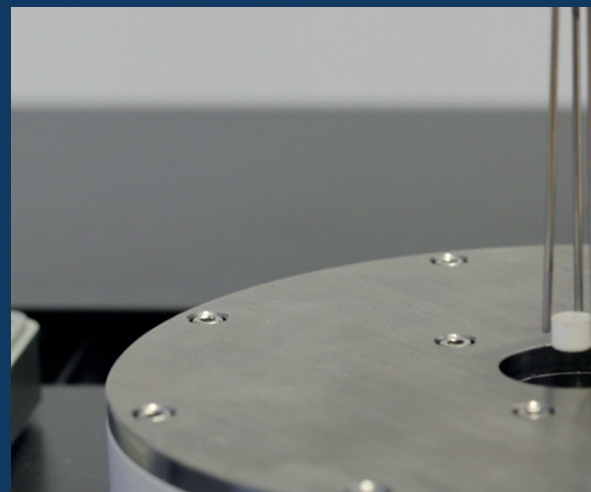
Optional gas analysis with MS, FTIR, or GCMS is possible, providing valuable additional information. The system can be configured with standalone and integrated MFC for gas dosing. Additionally, customer-specific options such as a heated inlet can also be integrated into the device.

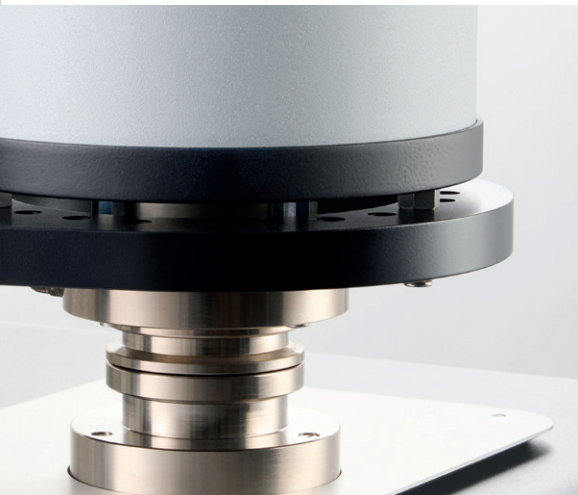
## Gas safety system

The gas safety system is designed to accommodate various gases such as hydrogen or carbon dioxide, ensuring secure operation and user safety.

## Controlled humidity and water vapour

The device can regulate the humidity and water vapour during the measurement.





### Wide temperature range -150 °C to 2400 °C

The LINSEIS STA/TGA instruments can be equipped with up to two furnaces at the same time. A broad variety of different furnaces are available to enable measurements in the widest temperature range on the market.

### Automatic calibration

We offer an automatic calibration function in the software and hardware. With this function, our STA automatically calculates a calibration factor, which is also displayed.

### Integrated LINSEIS platform

The integrated LINSEIS software offers a comprehensive solution, combining both hardware and software for maximum process security and precision. By providing a unified platform, it ensures seamless integration of components and devices from external partners, resulting in a highly robust system.

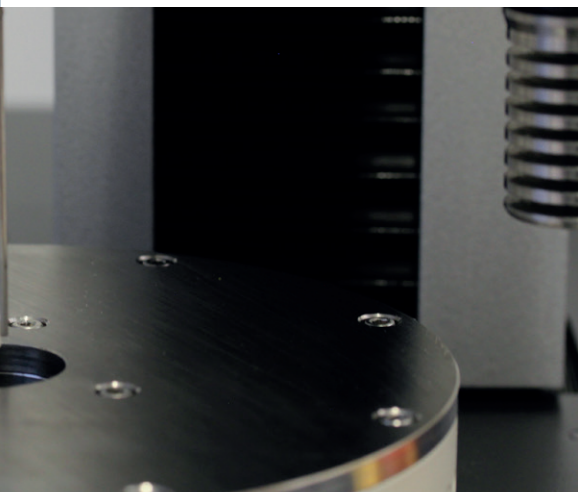


### Customization

Close collaboration with the customers to tailor unique solutions, leveraging LINSEIS expertise to meet their specific needs.

### Service

Our international presence across every continent enables us to deliver the best and fastest service possible.



### Accessories starter kit

The accessory starter kit guarantees fast and uncomplicated usage, serving as a complete system for instant application.





## Equipment for gas control and safety (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)

All Linseis instruments can be prepared for the use in hydrogen atmosphere with just minor adjustments. The most important thing is a safety system that can ensure that there is no leakage and no explosive atmosphere generated outside of the instrument. Therefore, the Linseis safety system uses hydrogen sensors that are coupled to an automatic gas control panel. If there is a leakage or unwanted hydrogen release, the instrument is automatically flooded with inert gas and the hydrogen valves are closed. This ensures a minimum risk level during operation. Besides that, the system contains an optional burn off unit where the gas outlet is connected to, to ensure that also the used gas of the measurement chamber is not just released into the environment. The system can also be operated with several combinations of inert gases and even water vapor besides hydrogen.

### In summary, the Linseis safety system comes with the following benefits:

- Automatic evacuation function
- Gas flow control for multiple gases including water vapor and hydrogen
- Emergency shutdown function
- Gas detector system (H<sub>2</sub>, CO, CO<sub>2</sub>, etc...)
- optional burn off unit
- Continuous monitoring to ensure safe operating conditions



Fig. 1

# Linseis equipment for operation under water vapor and controlled relative humidity

For many applications in thermal analysis, the atmosphere plays an important role as it may affect the sample behavior or activate reactions. Humidity influence on building materials, storage time of pharmaceuticals and foods or influence on mechanical properties of polymers are just some of the most common examples. Of course, the Linseis instruments are suitable for such experiments, however there is one fact that is often causing confusion and must be considered carefully: The difference between water vapor and relative humidity.

Relative Humidity Generators are most commonly used for experiments around room temperature, while water vapor applications are most often at higher temperatures. When water is heated to its boiling point or higher than that, the water changes its aggregate form from liquid to gaseous. It is then existing as water vapor (steam). If this steam is introduced into any kind of reaction chamber or instrument, it is called water vapor application. In contrast, every gas can transport and contain a certain amount of water at a given temperature. This is called humidity. Considering air as an example, there is always an amount of water contained in the air, even below the boiling point of water, which is defined as grade of humidity or relative humidity.

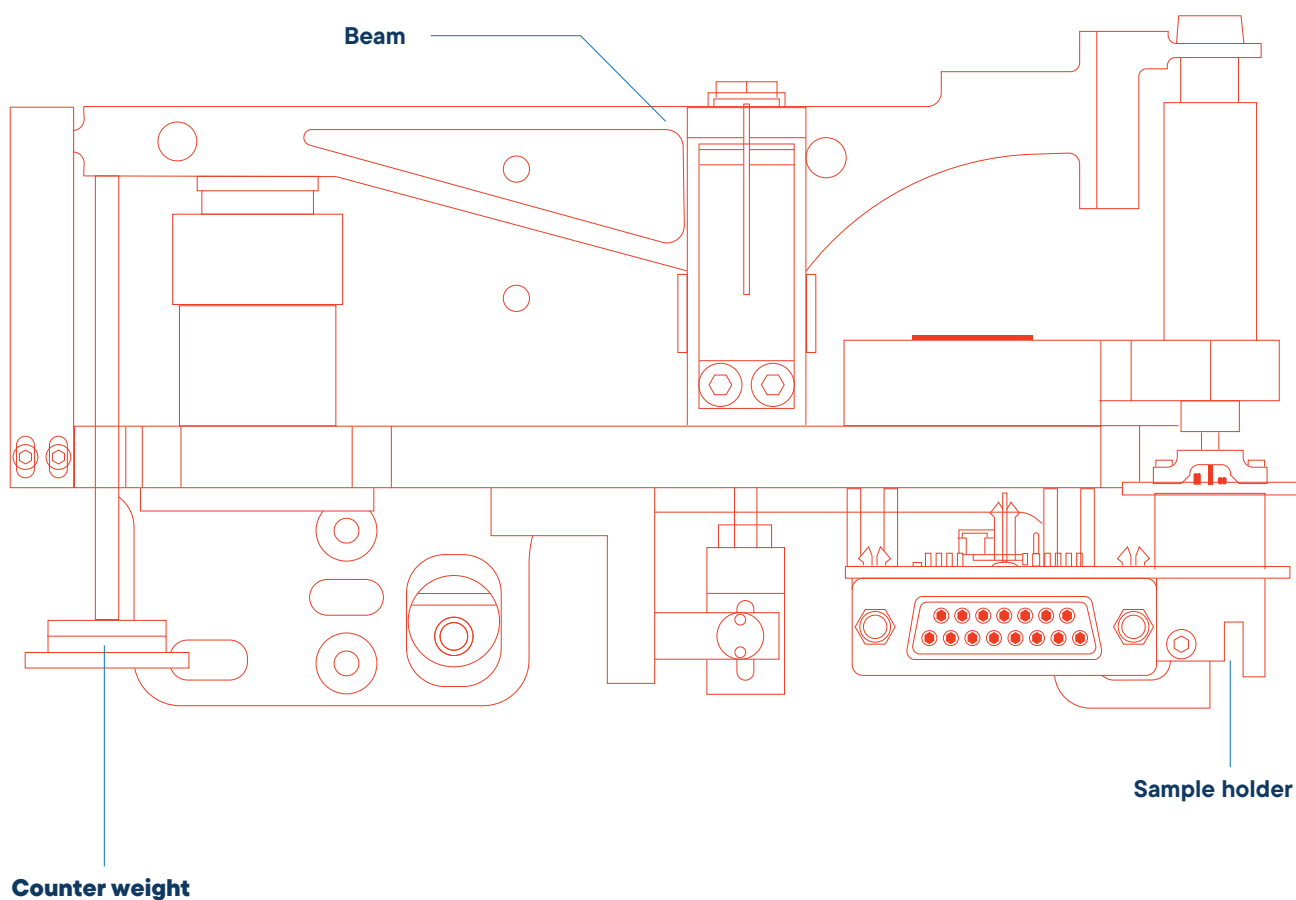


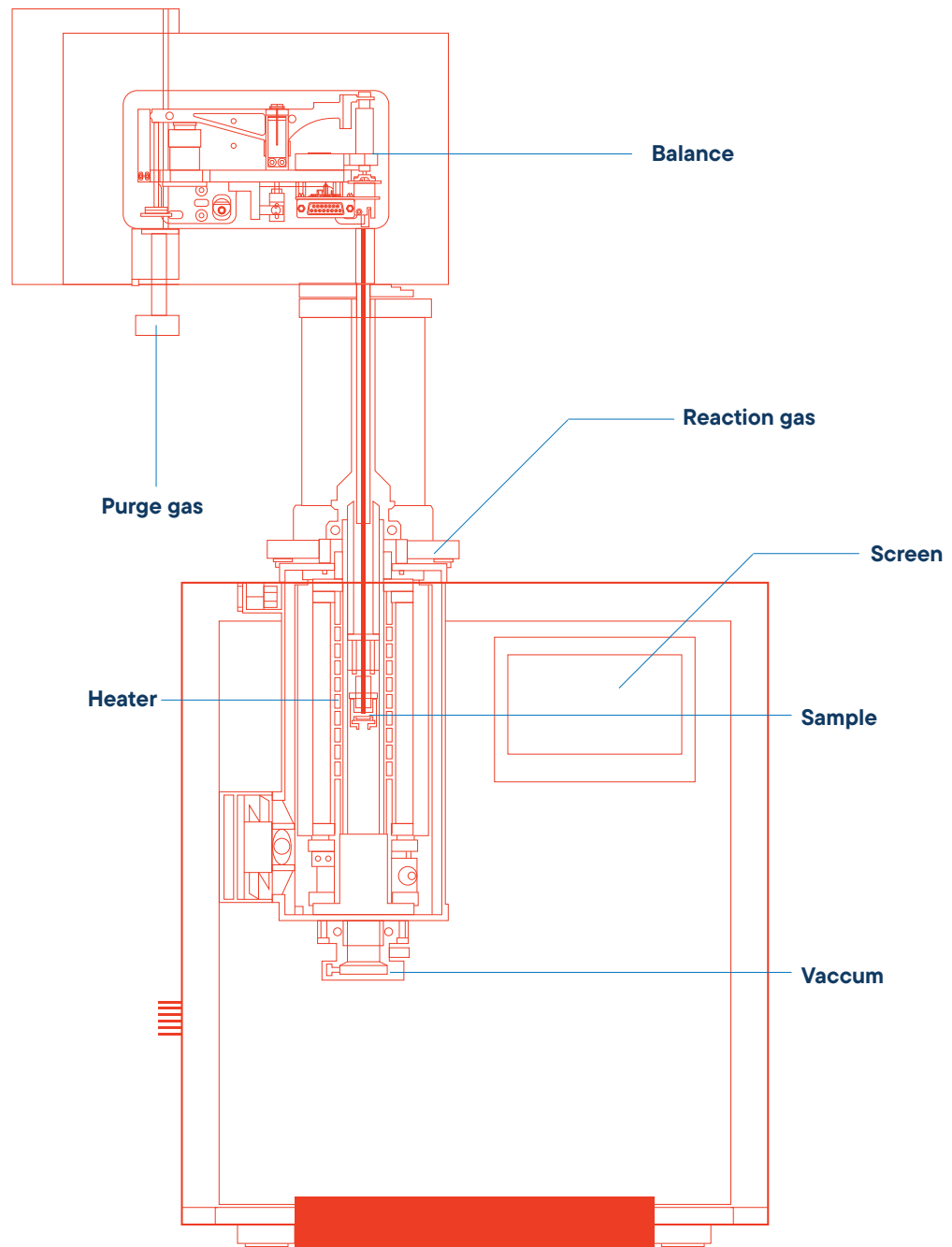
## Highest precision hanging scale

Our different microbalances are specifically designed to accomplish thermal analysis tasks in the best possible way.

Providing ultra light weight design to follow fast weight changes and symmetric construction for ultra low drift long term measurements.

Linseis micro balance  
especially designed for  
thermal  
analysis instruments





### Advantages of LINSEIS balance design

- Sample mass compensation by a counterweight enables improved sensitivity
- Improve symmetrical design for high interference levels
- Not affected by local gravity
- Not affected by thermal fluctuations

- Highest possible PRECISION
- Concept enables easy maintenance
- Depending on model, balance can handle from mg up to 50 g sample mass

### Advantages of combined TG+DSC

- Same geometry
- Stoichiometry
- Same temperature profile
- Same atmosphere
- Same humidity

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# Software

All LINSEIS thermo analytical instruments are software controlled. The individual software modules run exclusively under Microsoft® Windows® operating systems. The complete software consists of a data acquisition, data evaluation and administration module and incorporates all essentials: features for measurement preparation, execution and evaluation of a thermoanalytical measurement. Thanks to our specialists and application experts, LINSEIS was able to develop comprehensive, easy to understand, user friendly and application driven software.

## Features-Software:

- Data security in case of power failure
- Thermocouple break protection
- Repetition measurements with minimum parameter input
- Evaluation of current measurement
- Curve comparison of up to 50 curves
- Storage and export of evaluations
- Export and import in ASCII format
- Data export to MS Excel
- Multi-methods analysis (DSC, TG, TMA, DIL, etc.)
- Zoom function
- 1st and 2nd derivation
- Programmable gas control
- Curve arithmetics
- Statistical evaluation package
- Free scaling
- Automatic calibration
- Optional Kinetic and Lifetime Prediction
- Software packages
- Interface to MS and FTIR

## TG – Features:

- Mass change as % and mg
- Rate Controlled Mass Loss (RCML)
- Evaluation of mass loss
- Residue mass evaluation

## HDSC – Features:

- Glass transition temperature
- Complex peak evaluation
- Multipoint calibration for sample temperature
- Multipoint calibration for change of enthalpy
- Cp calibration for heat flow
- Signal-steered measuring procedures





The **LINSEIS Thermal Library** software package comes as an option for the well-known, user friendly LINSEIS LiEAP (Linseis Evaluation and Acquisition Platform) software that is integrated in almost all our instruments.

The Thermal Library allows the sample material identification by comparing the measurement curve with a data base providing thousands of references and standard materials within only 1-2 seconds.

### Multi-Instrument

LINSEIS instruments such as DSC, STA, TGA & LFA can be controlled with the same powerful LiEAP software platform.

### Multi-User

The administrator can generate different user levels providing different rights to operate the instrument. A optional Log file is also available.

### Report Generator

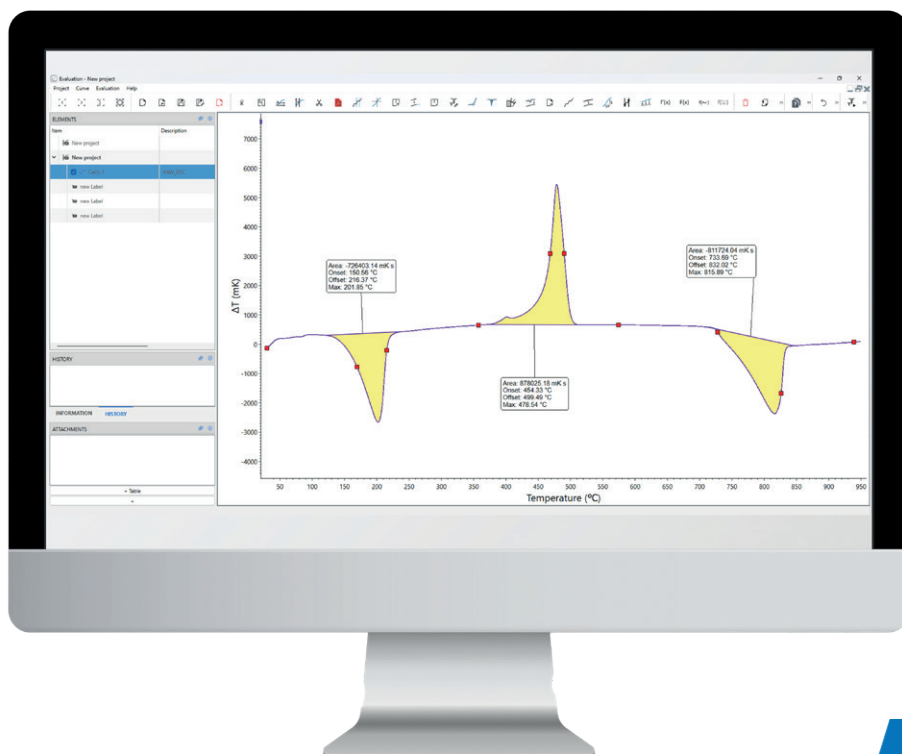
Convenient template selection to generate customized measurement reports.

### Database

State of the art database design enables easy data handling.

### Kinetic software

Kinetic analysis of DSC, DTA, TGA, EGA (TG-MS, TG-FTIR) data for the study of the thermal behavior of raw materials and products.





*Push  
bound*



# Whining Carries

# Technical Specifications

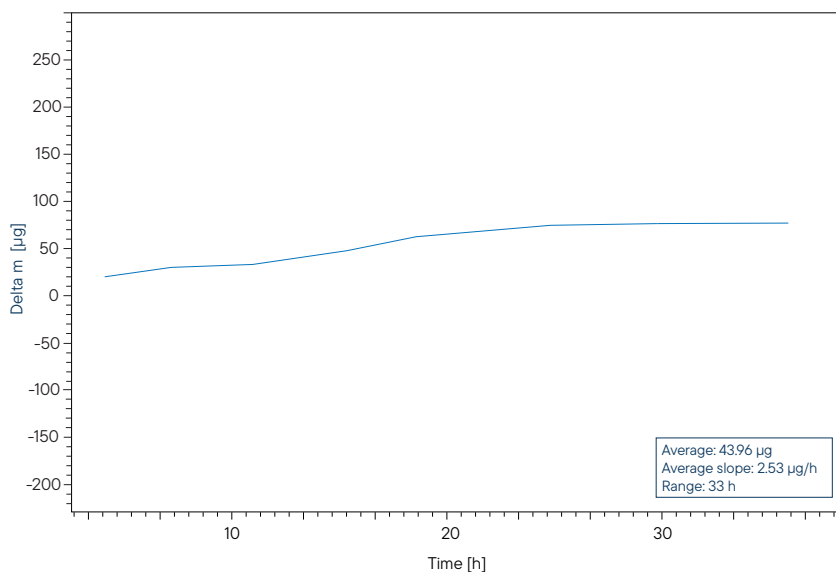
STA/TGA L86		
<b>Temperature range</b>	-150 °C up to 500 / 700 / 1000 °C RT up to 1000 / 1400 / 1600 / 1750 / 2000 / 2400 °C	
<b>Vacuum</b>	10 <sup>-5</sup> mbar (depends on vacuum pump)	
<b>Pressure</b>	up to 5 bar (optional)	
<b>Heating rate</b>	0.01 up to 100 K/min (depends on furnace) (from 0.001 °C/min on request)	
<b>Temperature precision</b>	0.001 °C	
<b>TG</b>	1	2
<b>Resolution</b>	0.01 µg	0.1 µg
<b>Sample weight</b>	Balance can read weight automatically	
<b>Measuring range</b>	5 g ± 2500 mg	50 g ± 2500 mg
<b>DSC</b>		
<b>DSC-sensors</b>	E / K / S / B / C (C = DTA only)	
<b>DSC resolution</b>	0.3 / 0.4 / 1 / 1.2 µW	
<b>Calorimetric sensitivity</b>	approx. 4 / 6 / 17.6 / 22.5 µW	
<b>DTA</b>		
<b>DTA-resolution</b>	0.03 nV	
<b>Sensitivity</b>	1.5 µV/mW	
<b>DTA-measuring ranges</b>	250 / 2500 µV	

# Applications STA/TGA L86



**STA Overview**

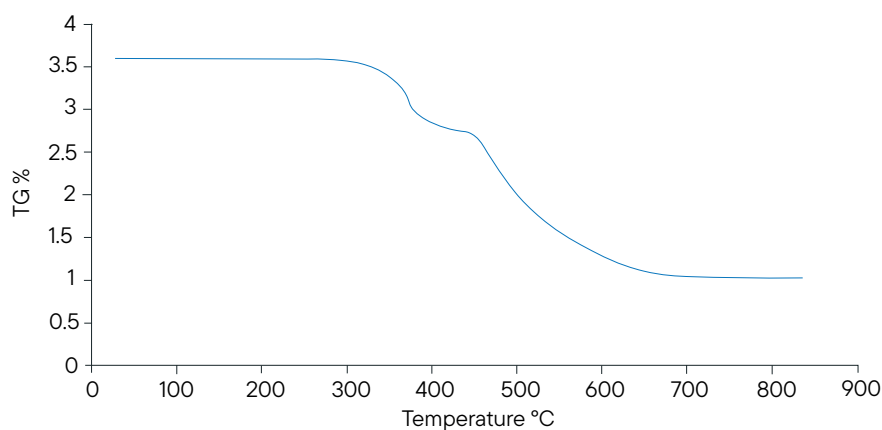
## Performance test: Isothermal drift



The new STA/TGA L86 system provides the best possible balance setup due to the hangig sensor design. In this drift study, the isothermal mass change was monitored for a period of 33 h at 500 °C.

During this measurement, the change rate of the signal was found to be roughly 2 µg/h which is an excellent value for a thermal balance.

## Application example: Titanium-Hydride



The TG signal of titanium hydride was measured up to 800 °C under argon atmosphere with a heating rate of 10 K/min.

Between 300 °C and 600 °C, a two-step mass loss of 2.3% in total was observed, corresponding to the decomposition of titanium hydride.

# ***LINSEIS***

*pushing boundaries*

## **LINSEIS GmbH Germany**

Vielitzerstr. 43  
95100 Selb

Tel.: (+49) 9287 880 0  
E-mail: [info@linseis.de](mailto:info@linseis.de)

## **LINSEIS Inc. USA**

109 North Gold Drive  
Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070  
E-mail: [info@linseis.com](mailto:info@linseis.com)

## **LINSEIS China**

Kaige Scientific Park  
Room 120, Building T3, No.1220  
Yuqiao Road, Pudong, Shanghai

Tel.: (+86) 61 90 12 03  
Tel.: (+86) 50 55 06 42  
E-mail: [info@linseis.com.cn](mailto:info@linseis.com.cn)

## **LINSEIS India**

Plot 65, 2nd Floor, Sai Enclave,  
Sector 23, Dwarka05-800  
110077 New Delhi

Tel.: +91-11-42883851  
E-mail: [sales@linseis.in](mailto:sales@linseis.in)



[WWW.LINSEIS.COM](http://WWW.LINSEIS.COM)

**LINSEIS**

T H E R M A L   A N A L Y S I S

# SIMULTANEOUS THERMAL ANALYSIS

STA HP L84

*(former STA HP 1/2)*



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Since 1957 LINSEIS Corporation has been delivering outstanding service, know how and leading innovative products in the field of thermal analysis and thermo physical properties.

Customer satisfaction, innovation, flexibility and high quality are what LINSEIS represents. Thanks to these fundamentals our company enjoys an exceptional reputation among the leading scientific and industrial organizations. LINSEIS has been offering highly innovative benchmark products for many years.

The LINSEIS business unit of thermal analysis is involved in the complete range of thermo analytical equipment for R&D as well as quality control. We support applications in sectors such as polymers, chemical industry, inorganic building materials and environmental analytics. In addition, thermo physical properties of solids, liquids and melts can be analyzed.

LINSEIS provides technological leadership. We develop and manufacture thermo analytic and thermo physical testing equipment to the highest standards and precision. Due to our innovative drive and precision, we are a leading manufacturer of thermal Analysis equipment.

The development of thermo analytical testing machines requires significant research and a high degree of precision. LINSEIS Corp. invests in this research to the benefit of our customers.

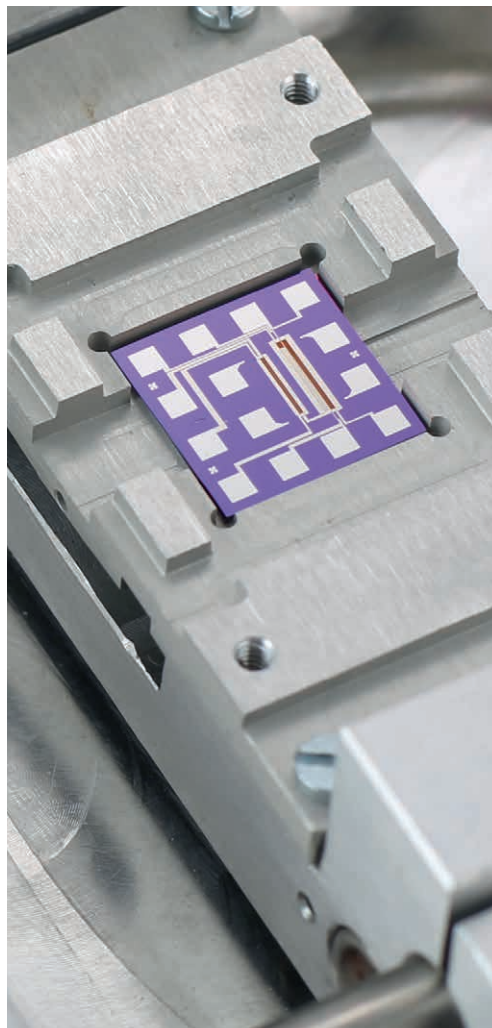


Claus Linseis  
Managing Director



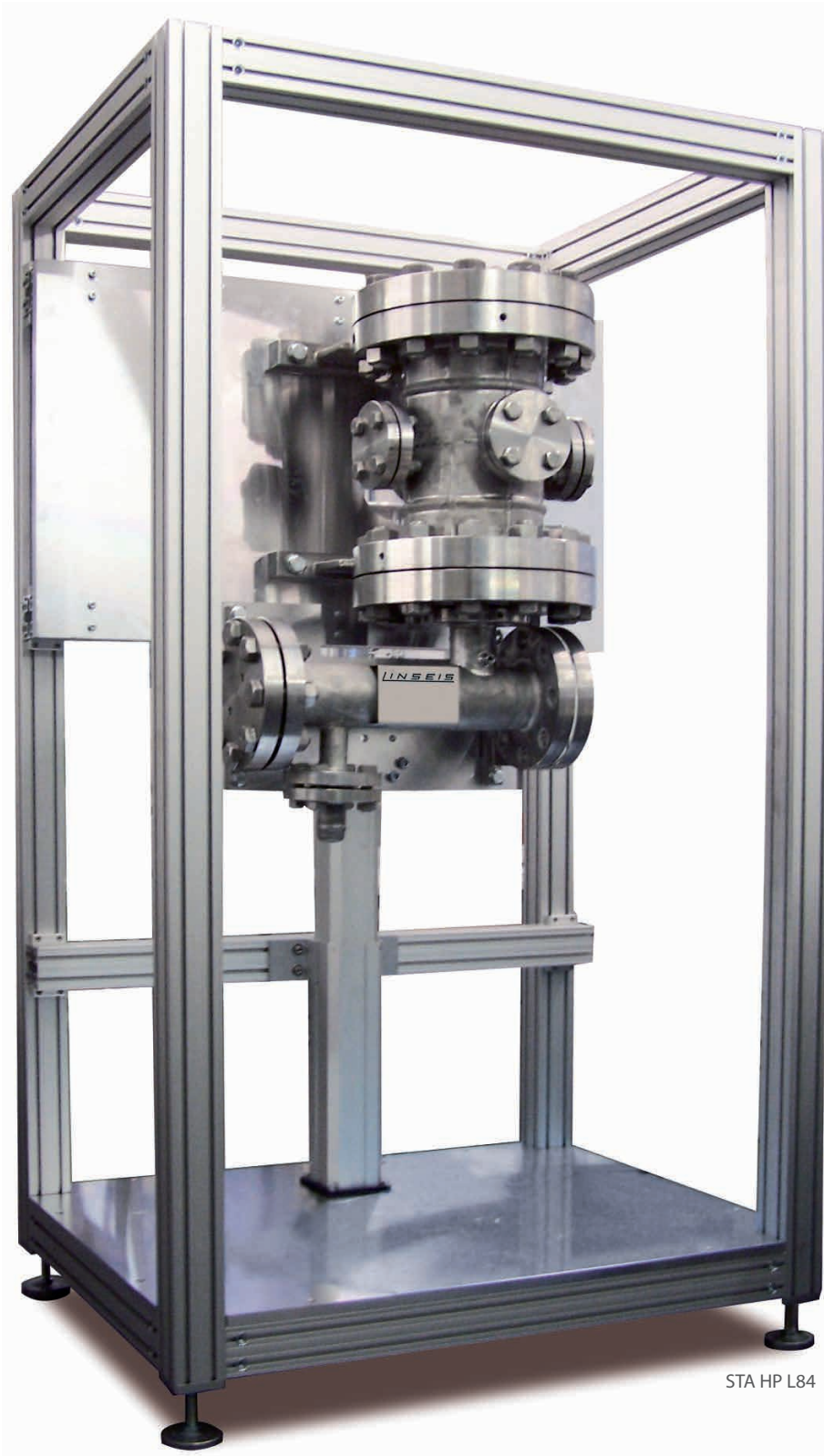
## German engineering

The strive for the best due diligence and accountability is part of our DNA. Our history is affected by German engineering and strict quality control.



## Innovation

We want to deliver the latest and best technology for our customers. LINSEIS continues to innovate and enhance our existing thermal analyzers. Our goal is constantly develop new technologies to enable continued discovery in Science.



STA HP L84

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# THE INSTRUMENT

Thermogravimetry is a technique in which the mass of the sample is monitored against time or temperature while the temperature of the sample, in a specified atmosphere, is programmed. This technique serves the determination of material compositions.

Simultaneous TGA-DTA/DSC measures both heat flow (DSC) and weight changes (TGA) in a material as a function of temperature or time in a controlled atmosphere. Simultaneous measurement of these two material properties not only improves productivity but also simplifies interpretation of the results. The complementary information obtained allows differentiation between endothermic and exothermic events which have no associated weight loss (e.g., melting and crystallization) and those which involve a weight loss (e.g., degradation).

The High Pressure LINSEIS STA (simultaneous thermal analysis) delivers unsurpassed performance. The system can be used to determine simultaneous changes of mass (TG) and caloric reactions (HDSC) under defined atmosphere and pressure (up to 150 bar) in the temperature range RT...1800°C. This instrument is worldwide the only available pressure STA.

The unique characteristics of this product are high precision, high resolution and long term drift stability. The STA Platinum Series was especially developed to meet the challenging de-

mands of the high temperature as well as high pressure applications.

From the combination of TG and DTA or DSC one receives a broad range of information, such as:

TG:

- Mass change
- Absolute sample temperature
- Temperature difference (sample / reference)

HDSC:

- Enthalpy, melting energy
- Specific heat
- Glass point
- Crystallinity
- Reaction enthalpy
- Thermal stability
- Oxidation stability
- Aging
- Purity
- Phase transformation
- Solidus / liquidus - relationship
- Eutecticum
- Polymorphism
- Product identification

Main Application of the STA HP:

- Pyrolysis studies
- Gasification of coal and biomass
- CO<sub>2</sub> sequestration
- Testing of getter materials (O<sub>2</sub>, H<sub>2</sub>, etc.)
- Metal reduction/oxidation studies

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# SOFTWARE

All LINSEIS thermo analytical instruments are PC controlled. The individual software modules exclusively run under Microsoft® Windows® operating systems. The complete software consists of 2 modules: data acquisition and data evaluation.

The 32 bit software incorporates all essential features for measurement preparation, execution, and evaluation of a Thermogravimetric measurement. Thanks to our specialists and application experts, LINSEIS was able to develop comprehensive easy to understand user friendly application software.

Features -Software:

- Data security in case of power failure
- Repetition measurements with minimum parameter input



- Evaluation of current measurement
- Curve comparison up to 32 curves
- Storage and export of evaluations
- Export and import of data ASCII
- Data export to MS Excel
- Report generator
- Database structure
- Redo and Undo function
- Multi-methods analysis (DSC TG, TMA, DIL, etc.)
- Zoom function
- 1 and 2 derivation
- Programmable gas control
- Statistical evaluation package
- Free scaling
- Program capable of text editing
- Thermocouple break protection

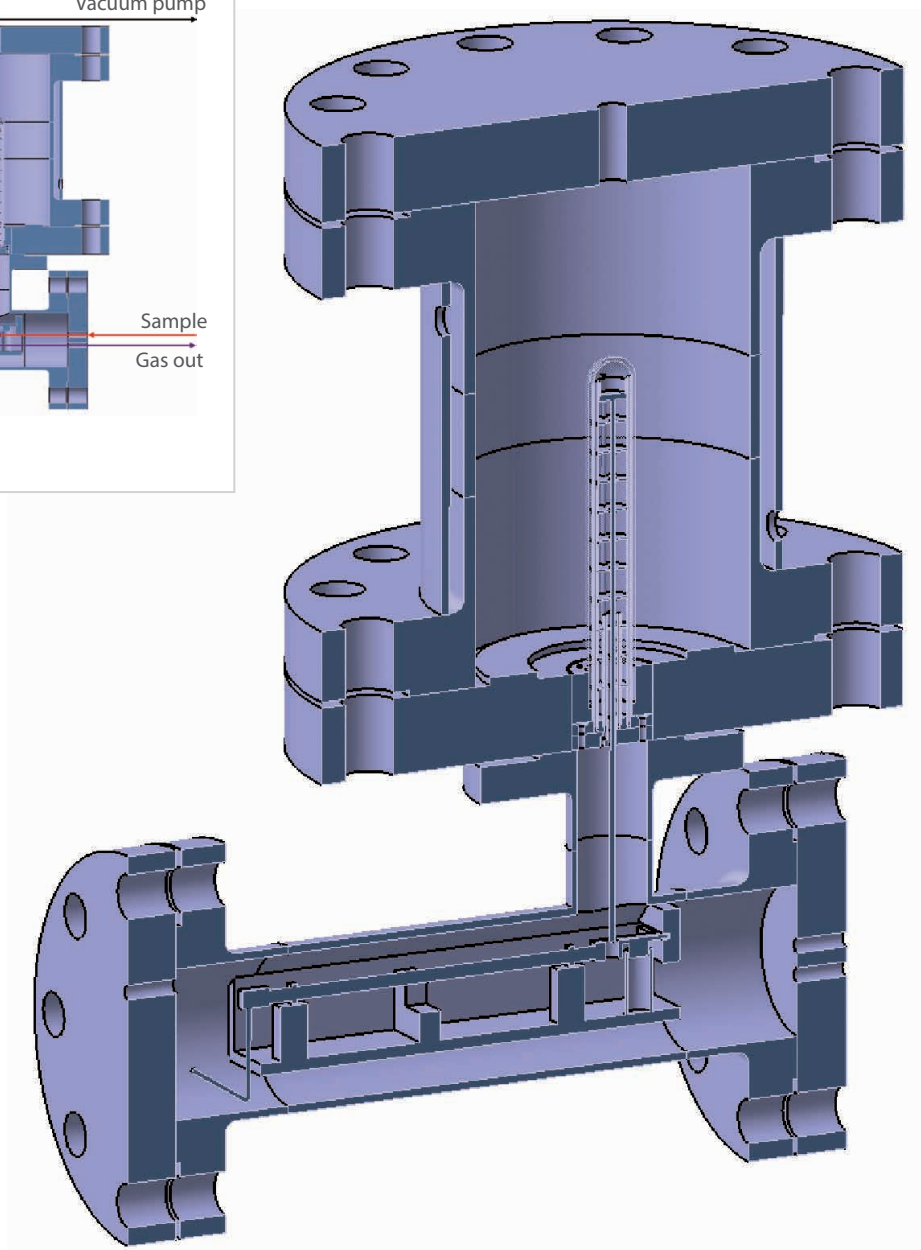
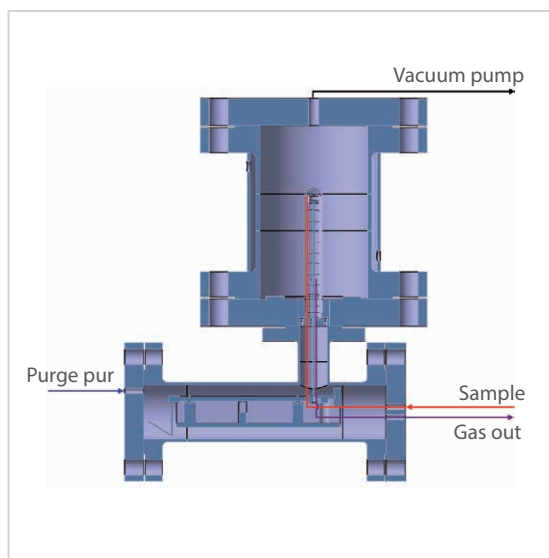
TG – Features:

- Mass change as % and mg
- Evaluation of mass loss
- Residue mass evaluation

HDSC – Features:

- Glass transition temperature
- Curve subtraction
- Complex peak evaluation
- Multipoint calibration for sample temperature
- Multipoint calibration for change of enthalpy
- Cp calibration for heat flow

# UNIQUE FEATURES



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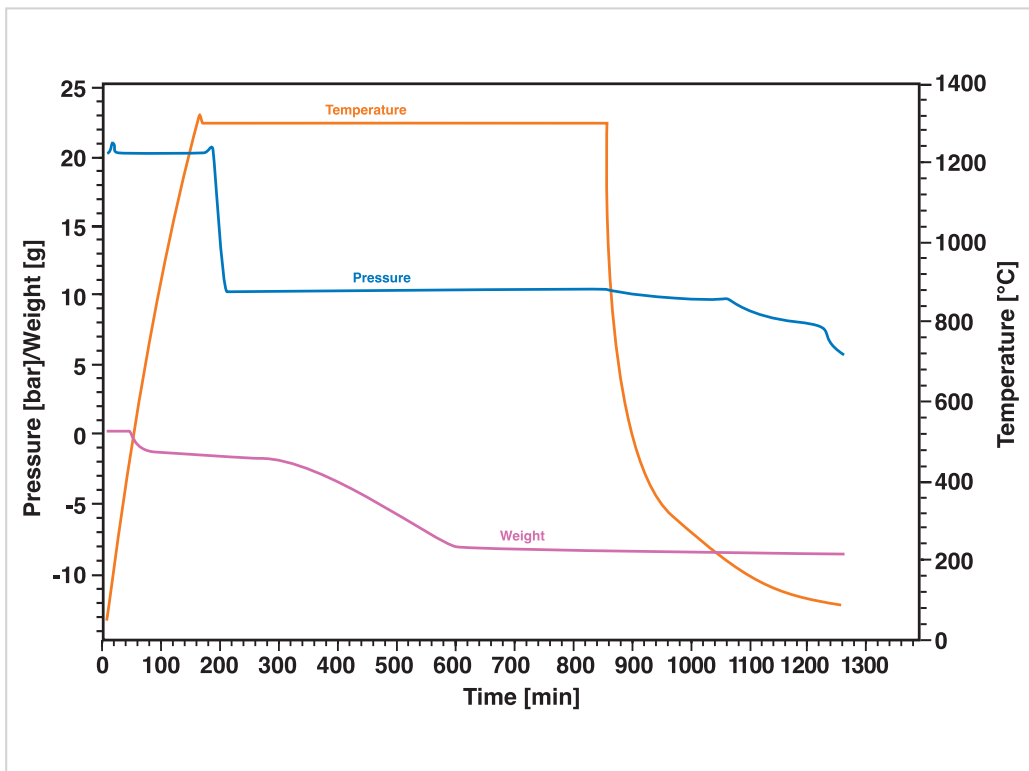
# SPECIFICATIONS

	STA HP L84 (former STA HP 1)	STA HP L84 (former STA HP 2)
Temperature range	RT up to 1100°C	RT up to 1400°C/1800°C
Heating element	Kanthal	SiC or graphite
Pressure range	up to 150 bar	up to 50 bar
Vacuum	up to 10 <sup>-4</sup> mbar	up to 10 <sup>-4</sup> mbar
TG resolution	0.1 / 0.5 / 10 µg	0.1 / 0.5µg
Sample weight	2 / 15 / 100g	2 / 15g
TG-DTA/DSC measuring systems	E/K/S/C	E/K/S/B/C
Atmosphere	inert, oxid., red., vac.	inert, oxid*, red., vac.

*\* Not possible with graphite heater*

# APPLICATIONS

## Coal gasification under CO<sub>2</sub>

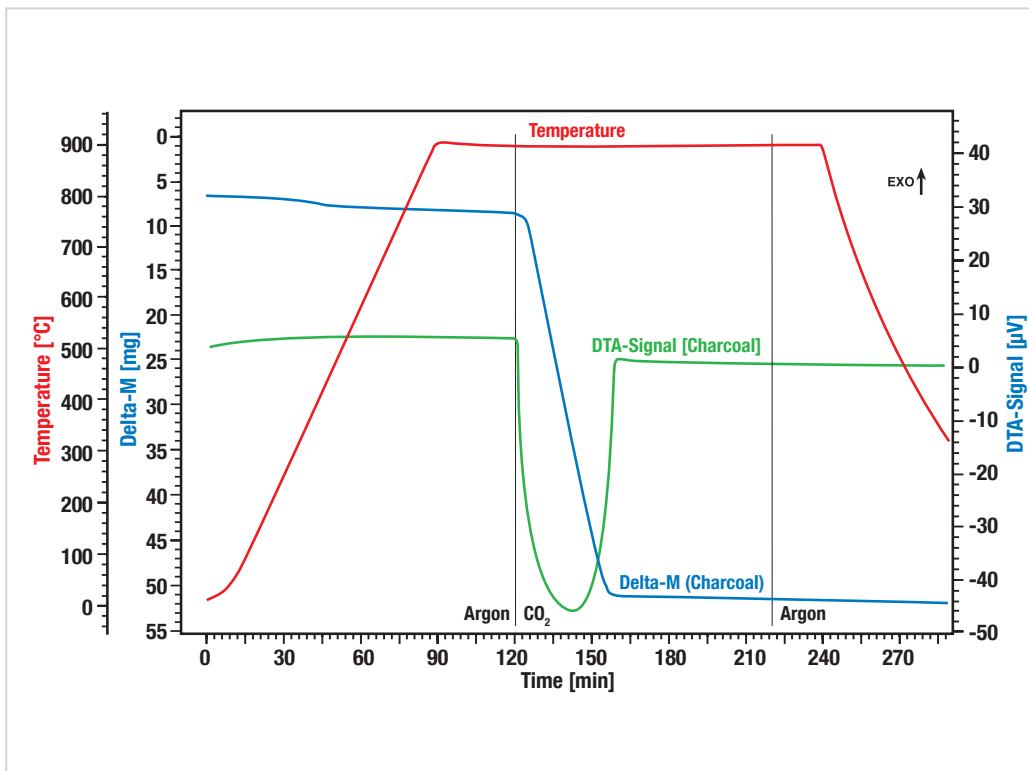


Example of coal sample being gasified under CO<sub>2</sub> atmosphere

Experimental conditions:

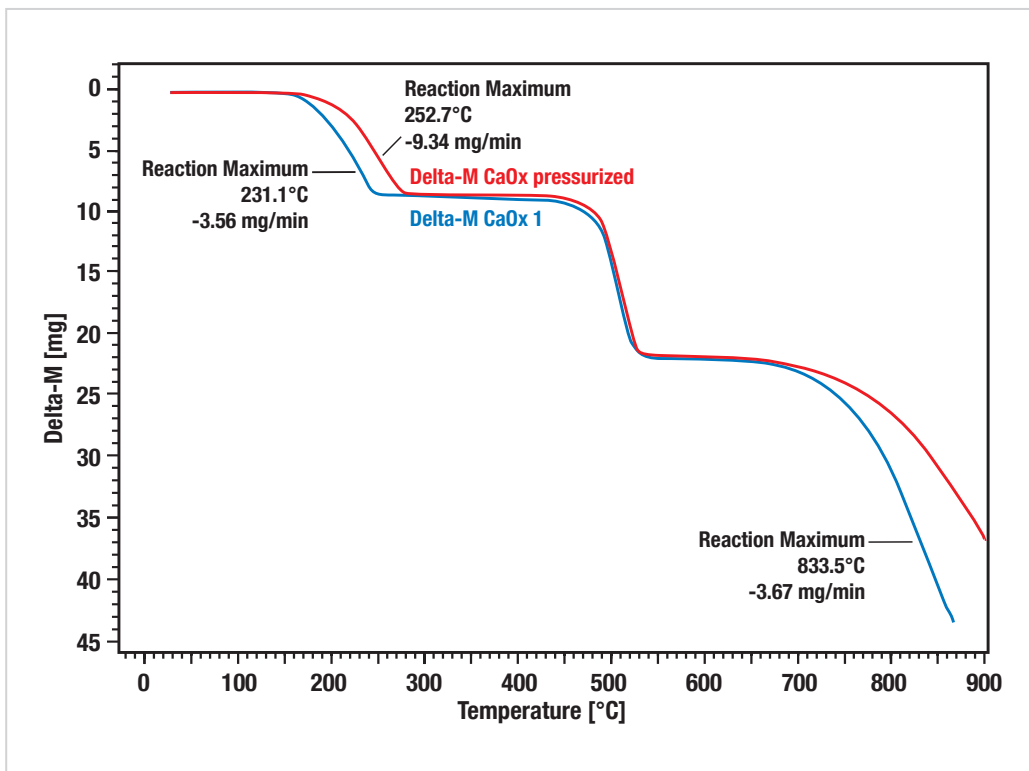
- 20 bar N<sub>2</sub> during heating,
- 10 bar CO<sub>2</sub> during gasification

## Charcoal gasification under carbon dioxide



This application shows a typical measurement of a Charcoal gasification under Carbon Dioxide atmosphere at a pressure of 20 bar.

## Calcium oxalate under different conditions



Comparison of Calcium Oxalate decomposition under Pressure (20 bar, red curve) vs. atmospheric condition (blue curve). A significant pressure dependence of the decomposition steps 1 and

3 can be observed. The decomposition steps 1 and 3 are shifted to higher temperatures at elevated pressure.



LINSEIS GmbH Germany

Vielitzerstr. 43

95100 Selb

Tel.: (+49) 9287-880 - 0

Fax: (+49) 9287-70488

E-mail: [info@linseis.de](mailto:info@linseis.de)



LINSEIS Inc. USA

109 North Gold Drive

Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070

Fax: (+1) 609 223 2074

E-mail: [info@linseis.com](mailto:info@linseis.com)



LINSEIS China

Kaige Scientific Park 2653 Hunan Road

201315 Shanghai

Tel.: (+21) 5055 0642

Fax.: (+21) 6806 3576



Linseis Thermal Analysis India

Pvt. Ltd.

Plot 65, 2nd Floor, Sai Enclave,

Sector 23, Dwarka, 110077

New Delhi

Tel.: +91-11-42883851

E-mail: [sales@linseis.in](mailto:sales@linseis.in)

[www.linseis.com](http://www.linseis.com)

Products: DIL, TG, STA, DSC, HDSC, DTA, TMA, MS/FTIR, In-Situ EGA, Laser Flash, Seebeck Effect, Thin Film Analyzer, Hall-Effect

Services: Service Lab, Calibration Service

03/25

**LINSEIS**

**LINSEIS**

T H E R M A L   A N A L Y S I S

**SIMULTANEOUS  
THERMAL  
ANALYSIS**

**STA HP L85**

*(former STA HP 3)*



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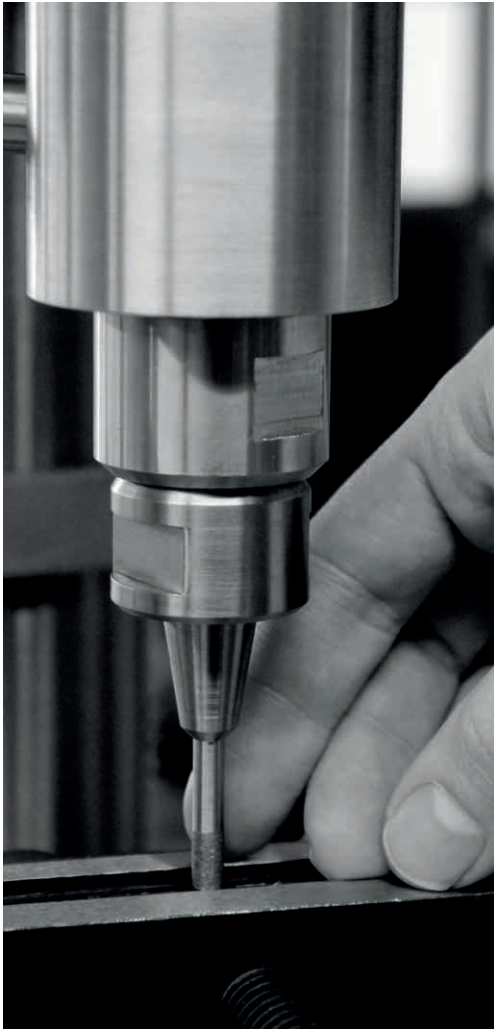
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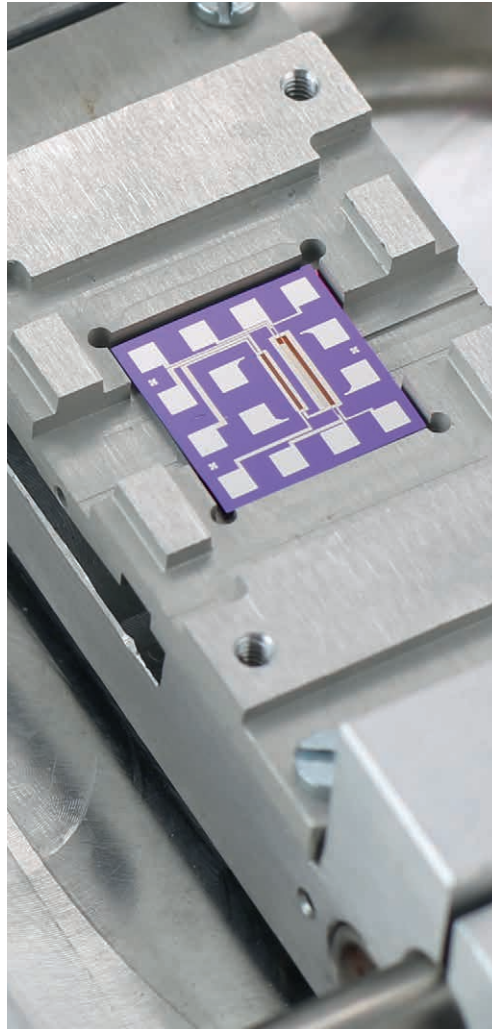


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# HIGH PRESSURE STA

Linseis introduces the all new STA HP L85 table top high pressure thermo-gravimetric, simultaneous thermal analysis instrument. The STA HP3 is the result of 25 years of experience thermal analysis under high pressure.

Worlds only top loading combined TG-DSC Thermogravimetry-differential scanning calorimetry. For experiments up to 1200°C and up to 150 bar in reactive or inert atmospheres.

The superior high speed micro-furnace with a maximum temperature of 1200°C, top loading microbalance, true TG-DSC Thermogravimetry-Differential Scanning Calorimetry design permit exiting new opportunities. The table top design, optional vapor generator and different gas dosing systems provides utmost flexibility.

## Various Sensors

Easy user exchangeable TGA or TG-DSC plug and play sensors. The right choice for any given experiment gives you the flexibility to analyze TGA only experiments with volumes up to 1 ml or combined TGA-DSC analysis with up to 0,12 or 0.3 ml volume.

TG-DSC Thermogravimetry-Differential Scanning Calorimetry arrangement permits the combined analysis of weight change and caloric events like endothermal or exothermal reac-

tions or phase transitions in one run and under the same temperature, gas and pressure conditions.

High accurate sample temperature measurement. The thermocouple is in direct contact with the sample. The configuration of the TGA/STA HP L85 eliminates temperature measurement errors due to sample – thermocouple distance (unlike levitating MSB-Magnetic Suspension Setup).

High speed micro heater permits rapid heating and cooling (up to 300°C/min controlled heating rate and up to 150°C/min cooling rate).

Very small furnace volume allows rapid gas changes. In addition the low volume lowers the cost of ownership (gas consumption/energy requirement) drastically.

## Flexible gas dosing and security design

Our gas dosing panels can be designed to your needs. Number of gases can be selected (1,2,3, 4, ...) optional vapor generator, automatic evacuation, gas burn off and safety system are available for gases like hydrogen and hydrocarbons.



Linseis STA HP L85 total setup including water vapor generator and automated MFC gas control panel



High precision mass flow controllers (MFC) and intelligent gas dosing and pressure system of a Linseis STA HP L84 guarantee optimum performance under various conditions in the full pressure and temperature range



Linseis TG measurement system for high pressure range. The unique table-top pressure system can be equipped with TG or TG-DSC sensor heads

# GAS EQUIPMENT



## Customized gas control

The LINSEIS TGA/STA HP L85 series can be equipped with any number of mass flow controllers (MFCs), depending on the customer's needs, to control, mix and handle a wide range of gases. This allows full control of atmospheres from  $10^{-4}$  mbar up to 150 bar in a temperature range from room temperature up to 1200°C.

Additionally, there is the possibility to add condensate traps, water vapor generators and also heated transfer lines for dosing of steam and other condensing gases. All gas control panels fulfill high German quality and safety standards and are user friendly designed to guarantee best possible performance.

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# SOFTWARE

The all new Platinum Software greatly enhances your workflow as the intuitive data handling only requires minimum parameter input.

AutoEval offers a valuable guidance for the user when evaluating standard processes such as glass transitions or melting points. Thermal library product identification tool, provides a database with 600 polymers permitting an auto-matic identification tool for your tested polymer. Instrument control and/or surveillance through mobile devices gives you control wherever you are.

- Software packages are compatible with latest Windows operating system
- Set up menu entries
- All specific measuring parameters (User, Lab, Sample, Company, etc.)
- Optional password and user levels
- Undo and Redo function for all steps
- Infinite heating, cooling or dwell time segments
- Multiple language versions such as English,

German, French, Spanish, Chinese, Japanese, Russian, etc. (user selectable)

- Evaluation software features a number of functions enabling a complete evaluation of all types of data
- Multiple smoothing models
- Complete evaluation history (all steps can be undone)
- Evaluation and data acquisition can be performed simultaneously
- Data can be corrected using zero and calibration correction
- Data evaluation includes: Peak separation software Signal correction and smoothing, first and second derivative, curve arithmetic, data peak evaluation, glass point evaluation, slope correction. Zoom / individual segment display, multiple curve overlay, annotation and drawing tools, copy to clip board function, multiple export features for graphic and data export, reference based correction



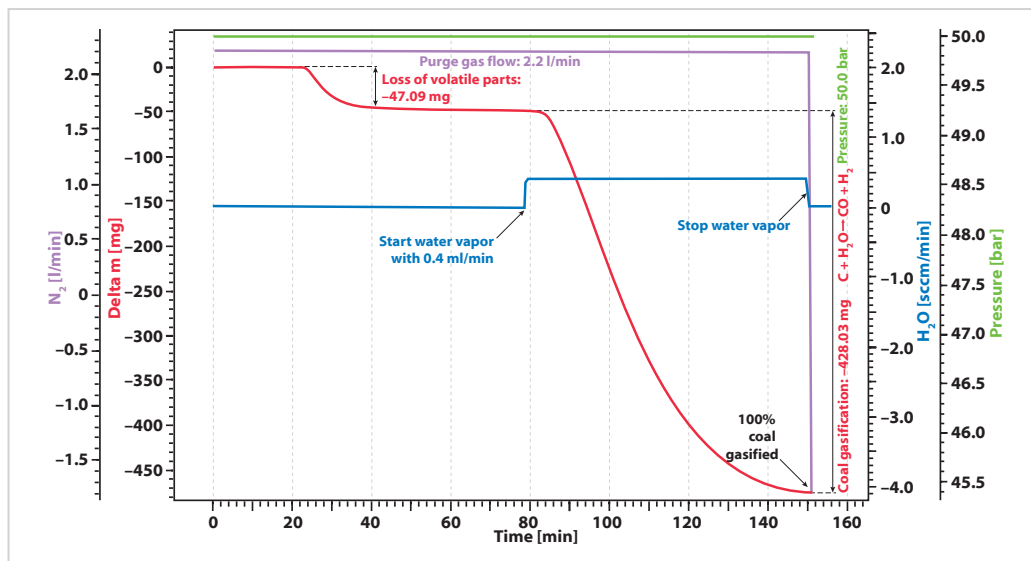
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# SPECIFICATIONS

	STA HP L85 (former STA HP 3)
Temperature range	RT up to 1200°C
Pressure range	up to 150 bar
Sample mass	Up to 5 g
Resolution	0.1 µg
Vacuum	10 <sup>-4</sup> mbar
TG-sensors	Type E/K/S/B/C
TG-DSC sensors	Type E/K/S/B/C
Electronics	Integrated or separation on electronics
Interface	USB or Ethernet
Vapor generator	Optional
Gas dosing	1,2 or 3 gases or more on request

# APPLICATION

## Coal gasification



A common known application for HDSC measurements is the investigation of the so called coal gasification or hydro gasification. This process, where carbon is heated in a water steam atmosphere is used in some catalytical processes, for example to remove carbon monoxide (CO) from exhaust fumes and especially to get valuable organic compounds out from resources like charcoal or biomass.

The whole process can be described like this:

Charcoal or the Carbon parts of Biomass react with water vapour to a mixture of carbon monoxide and hydrogen at higher temperatures ( $C + H_2O \rightarrow CO + H_2$ ).

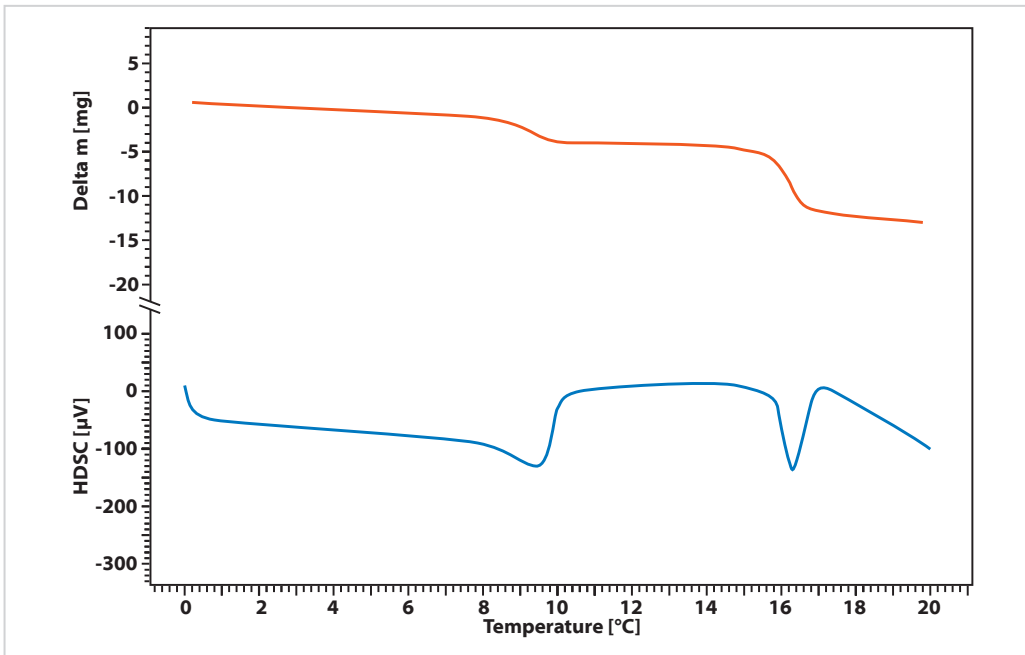
This process can be done with or without additional oxygen. If an oxygen containing atmosphere is used, you will also get additional carbon monoxide according to ( $C + O_2 \rightarrow CO_2$  followed by  $C + CO_2 \rightleftharpoons 2 CO$ ) The third equation, no matter if

you use oxygen or not, shows the reaction of carbon monoxide with water to get more hydrogen ( $CO + H_2O \rightleftharpoons CO_2 + H_2$ ). So in the end you will get a mixture of carbon monoxide and hydrogen.

Those two gases are involved in chemical balances and therefore sometimes it is also interesting, to know how much pressure you have in your system, because the pressure determines on which side of the equation the balance will be. Finally, the purpose of the coal gasification is, that you can get methanol and methane out of the two created gases carbon monoxide and hydrogen ( $CO + 2 H_2 \rightleftharpoons CH_3OH$ ;  $CH_3OH + H_2 \rightleftharpoons CH_4$ ) That means with this process you can get from any kind of carbon to the basic building block of almost every organic compound (drugs, polymers, oils, waxes, fatty acids, organic acids and so on).

# APPLICATIONS

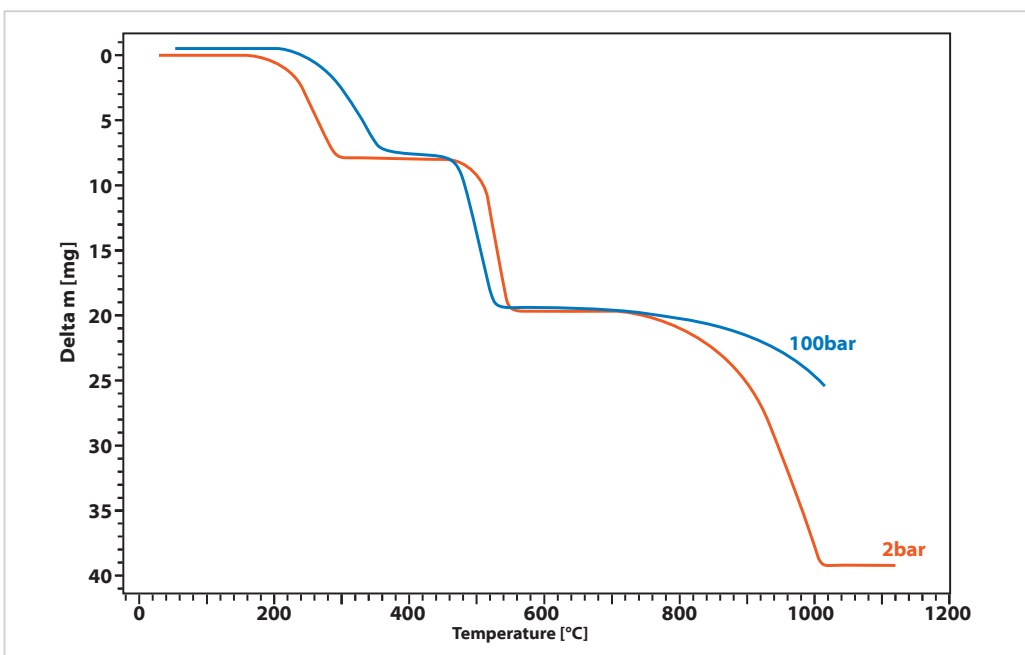
## Measurement of Calciumoxalate at 100bar constant pressure in STA HP L85



The STA HP L85 can be operated also at high pressures such as 100bar. The scheme shows the DSC and TG signal of a calcium oxalate run in 100 bar static nitrogen atmosphere at a linear heating rate of 20K/min up to 600°C.

The red TG curve shows the first two mass loss steps that are well known for calcium oxalate. However the first effect is shifted in temperature due to the high ambient pressure. The first effect is the loss of water, where it is notable that the enthalpy peak ends clearly after the mass loss effect which means the water is released but still need more energy to evaporate due to the high ambient pressure. The second peak is the loss of carbon monoxide which happens at nearly the same temperature like at lower pressures. The reason is that this effect is a structural decomposition reaction that is happening independent from ambient pressure. Even if the CO is finally released it is not so much affected by the high pressure and part of an irreversible decomposition.

## STA HP L85 pressure influence on the thermal decomposition of CalciumoxalateCalcium

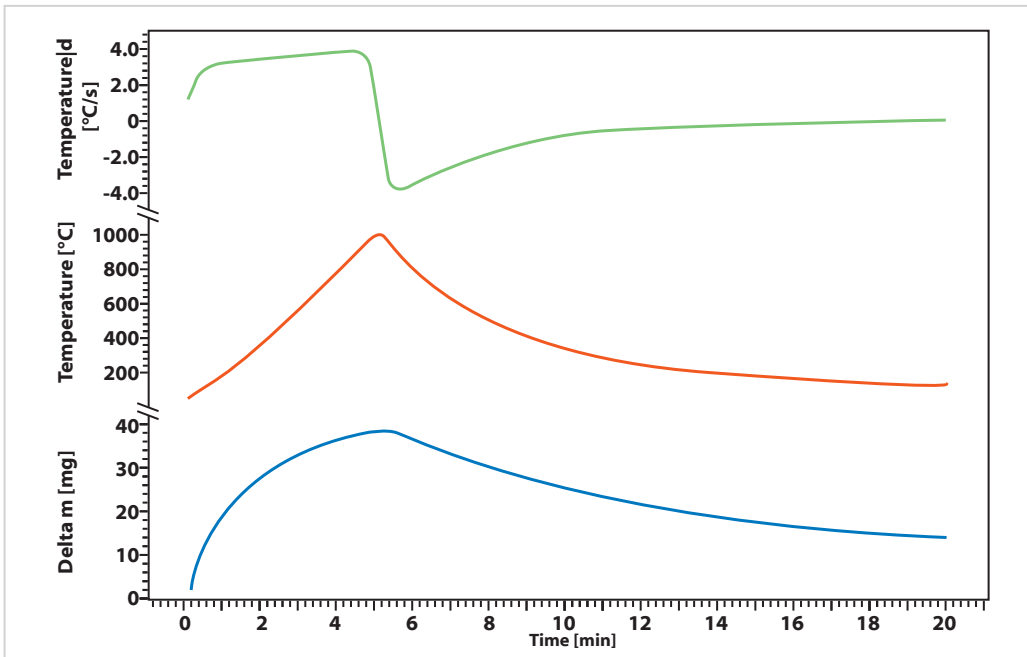


The substance calcium oxalate monohydrate is a common known reference material for thermo-balances and DSCs. It decomposes thermally in three definite mass loss steps that are caused by the release of water (a), the release of carbon monoxide (b) and the release of carbon dioxide (c).

Also in pressurized atmospheres, these effects can be seen, however they see a pressure depending shift on the temperature axis. The scheme shows the decomposition of calcium oxalate monohydrate at 2 bar and 100 bar nitrogen atmosphere, measured by Linseis STA HP L85.

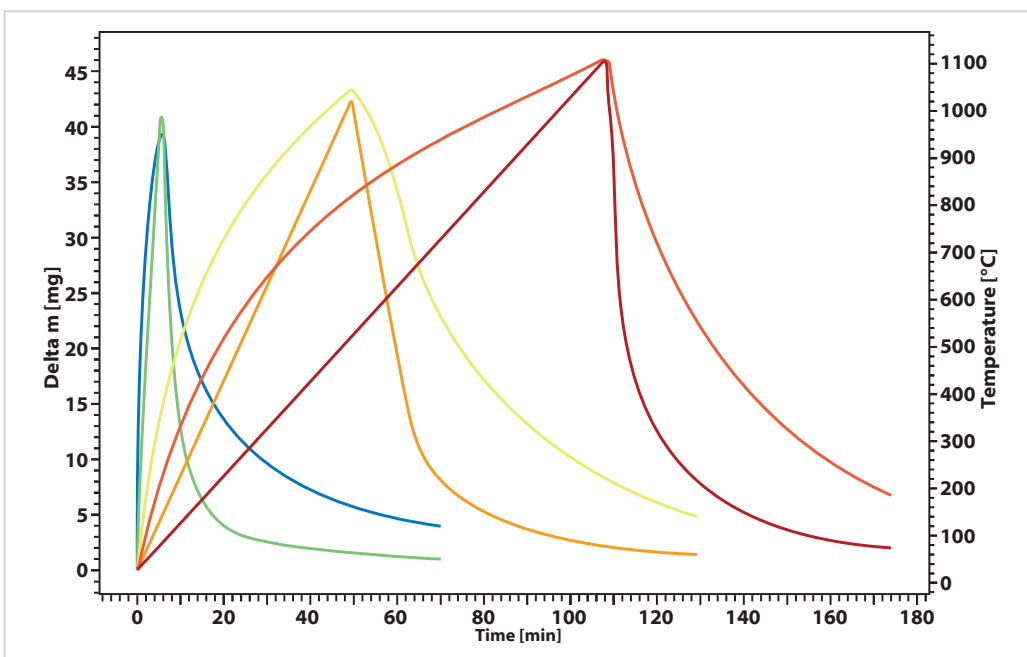
The first and last effect are clearly occurring later at the higher pressure (blue curve), while the second effect (b) is happening a little bit earlier. The reason is that the decomposition that releases the water and CO<sub>2</sub> are reversible under higher pressure and therefore are delayed, while the decomposition step (b), the loss of CO is an irreversible decomposition reaction that is independent of ambient pressure.

## Heating and cooling rates of STA HP L85 at 100 bar constant pressure



The curves were measured with an empty crucible at 100bar constant ambient pressure using the STA HP L85. The heating rates and cooling rates were determined using the derivative over time (red curve). The programmed heating rate was 200K/min which was reached after a short initial phase. The cooling was passive ballistic cooling, resulting in maximum cooling rates of up to 200 K/min at the beginning. Below 300°C, a constant cooling rate of 50K/min is still possible. As can be seen, the whole experiment (heating from room temperature to 1000°C and cooling down to 100°C) can be done in just 20 minutes, even at high pressures.

## STA HP L85 comparison of fast heating rates



The unique furnace design of the STA HP L85 allows ultra-fast heating rates, even in pressurized experimental setups. The curves show the zero curves of an empty system at 10, 20 and 200 K/min at constant pressure of 10 bar nitrogen. As you can see even at fast heating speed, there is the same noise level and accuracy than with slower rates. Each curve was measured twice, to show the reproducibility which is also excellent as can be seen above.



LINSEIS GmbH Germany

Vielitzerstr. 43

95100 Selb

Tel.: (+49) 9287 880 0

E-mail: [info@linseis.de](mailto:info@linseis.de)



LINSEIS Inc. USA

109 North Gold Drive

Robbinsville, NJ 08691

Tel.: (+1) 609 223 2070

Fax: (+1) 609 223 2074

E-mail: [info@linseis.com](mailto:info@linseis.com)



LINSEIS China

Kaige Scientific Park 2653 Hunan Road

201315 Shanghai

Tel.: (+86) 21 5055 0642

Tel.: (+86) 10 6223 7812

E-mail: [info@linseis.de](mailto:info@linseis.de)



Linseis Thermal Analysis India Pvt. Ltd.

Plot 65, 2nd Floor, Sai Enclave,

Sector 23, Dwarka, 110077 New Delhi

Tel.: +91-11-42883851

E-mail: [sales@linseis.in](mailto:sales@linseis.in)

[www.linseis.com](http://www.linseis.com)

Products: DIL, TG, STA, DSC, HDSC, DTA, TMA, MS/FTIR, In-Situ EGA, Laser Flash, Seebeck Effect, Thin Film Analyzer, Hall-Effect

Services: Service Lab, Calibration Service

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