LINSEIS

pushing boundaries

L63 DSC

Differential Scanning **Calorimeter**

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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 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.

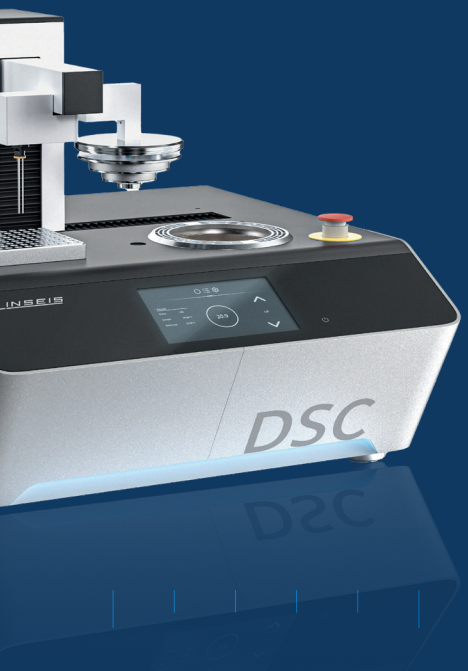
C L A U S L I N S E I S

C E O D I P L . P H Y S .

Engineering & Innovation

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.



Differential Scanning **Calorimetry**

Differential Scanning Calorimetry (DSC) is one of the central methods of thermal analysis: Indispensable when it comes to precisely investigating endothermic and exothermic transitions. It provides detailed insights into the thermal behavior of materials – as a function of temperature and time with high significance.

Typical applications range from the characterization of polymers, pharmaceuticals, foodstuffs to organic and inorganic substances. Measurable transitions include glass transitions, melting, crystallization, curing, reaction kinetics, oxidation stability (OIT) as well as heat capacities.

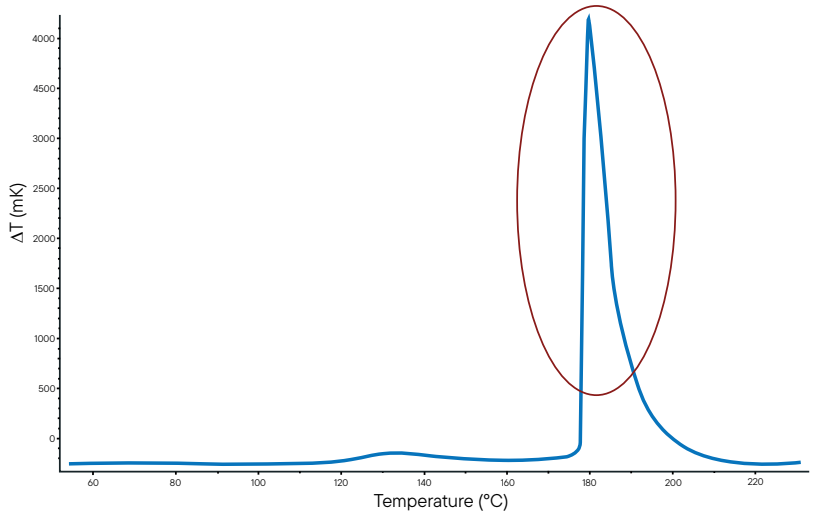
Thanks to its high sensitivity and reproducibility, the LINSEIS DSC L63 is an indispensable tool in research, development and quality assurance—whenever thermal properties determine material behavior, processability or durability.

Unsurpassed performance

- **Unsurpassed Sensitivity**
  Ideal for detecting melts and weak transitions
- **Benchmark Resolution**
  Precise separation of close lying events
- **Reliable Automation**
  Up to 90 position autosampler
- **Widest Temperature Range**
  From -170 °C up to 750 °C in one measurement

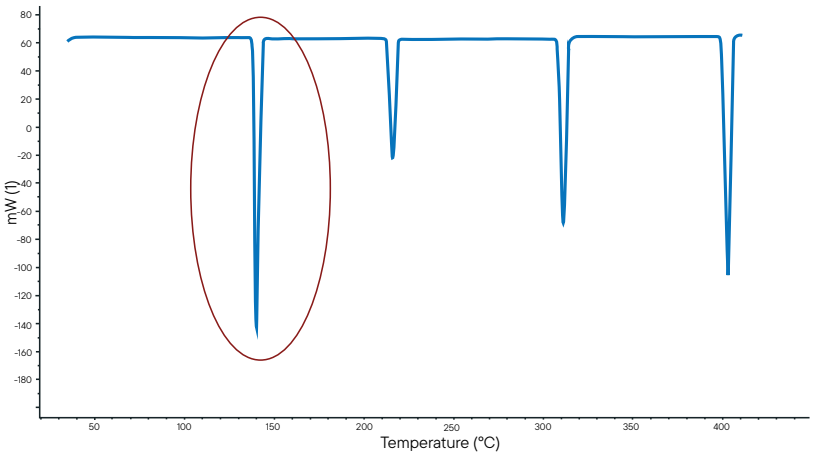
The LINSEIS DSC's operate in agreement with national and international standards

ASTM C 351 · D 3417 · D 3418 · D 3895 · D 4565 · E 793 · E 794
DIN 51004 · 51007 · 53765 · 65467
DIN EN/ISO 728 · 10837 · 11357 · 11409



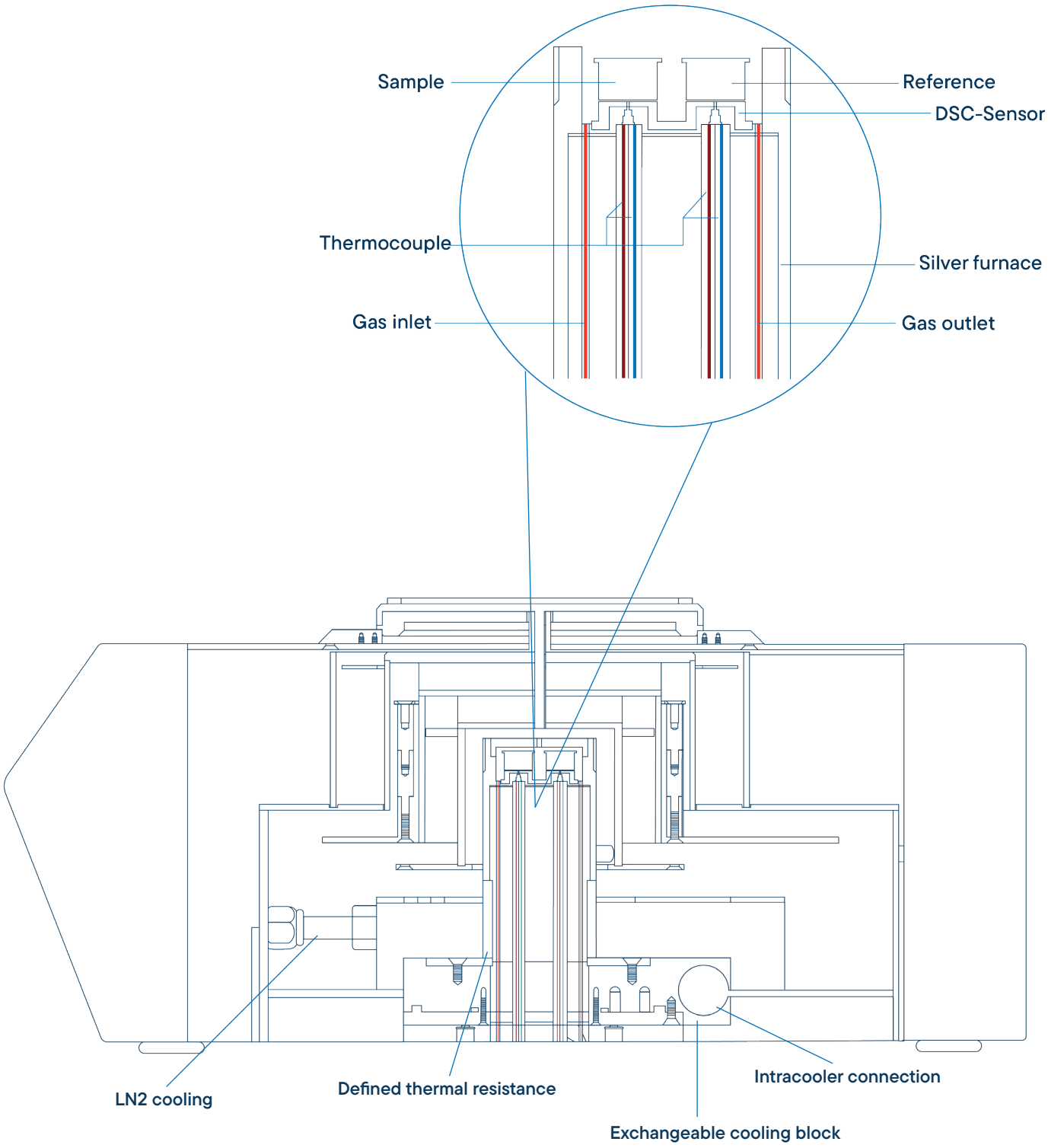
Exothermic Events

- Oxidation
- Cure Reactions
- Crystallization
- Polymorphic Transitions
- Decomposition



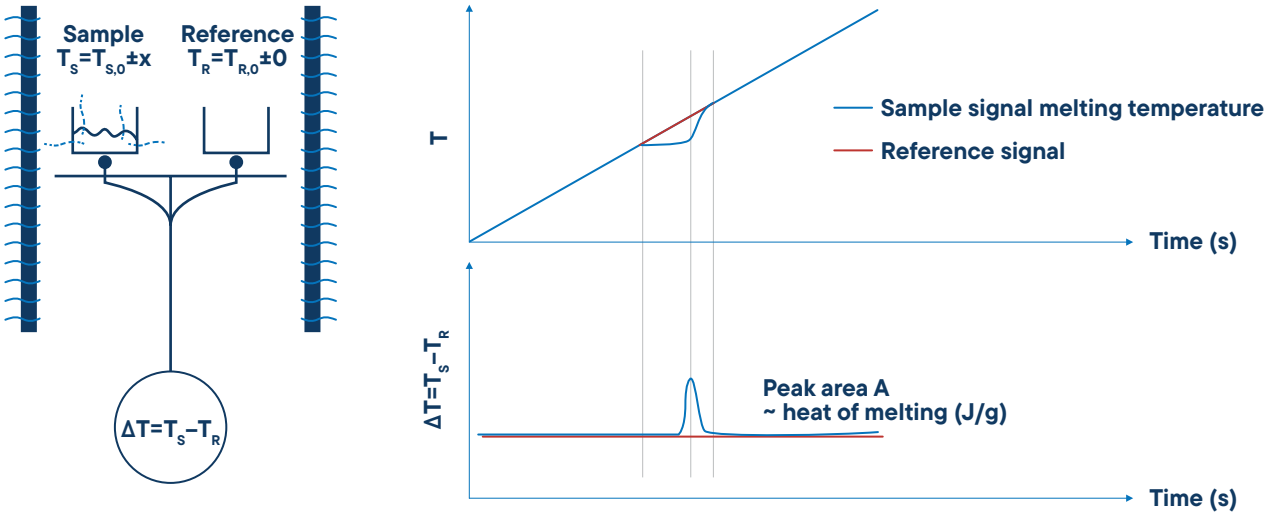
Endothermic Events

- Melting
- Glass transitions
- Enthalpic Recovery
- Polymorphic Transitions
- Evoration/Volatilization
- Decompositions


Sample
Reference
DSC-Sensor
Thermocouple
Silver furnace
Gas inlet
Gas outlet
LN2 cooling
Defined thermal resistance
Intracooler connection
Exchangeable cooling block

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

- Glass point
- Crystallinity
- Thermal stability
- Oxidation stability
- Purity
- Solidus relationship
- Liquidus relationship
- Product identification

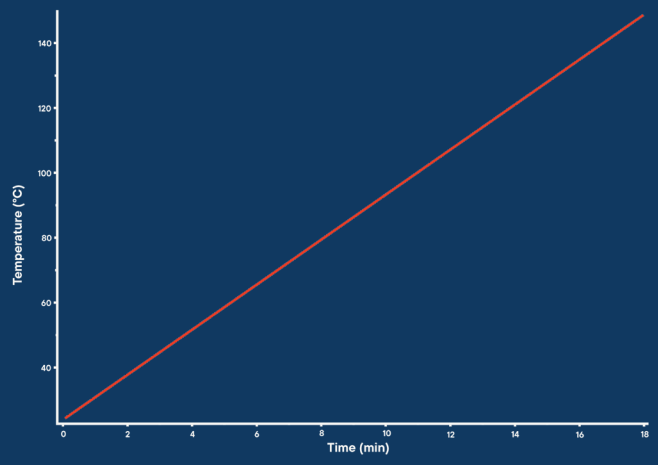
Modulated **DSC**

Differential scanning calorimetry (DSC) is an established method for analysing thermal transitions and reactions in materials. In classic DSC, measurements are taken at a constant heating rate, recording the entire heat flow generated by endothermic or exothermic processes. This provides reliable information about melting, glass transitions or crystallisation, for example.

Modulated DSC (MDSC) extends this principle: an additional sinusoidal temperature modulation allows the measured heat flow to be separated into reversible (e.g. glass transitions, melting) and non-reversible components (e.g. crystallisation, relaxation).
This makes it easier to differentiate between overlapping effects – a significant advantage for complex materials or weak transitions.
The precise determination of specific heat capacity (Cp) is particularly valuable in the study of polymers, composites and many others, as it reflects the material's ability to store thermal energy.

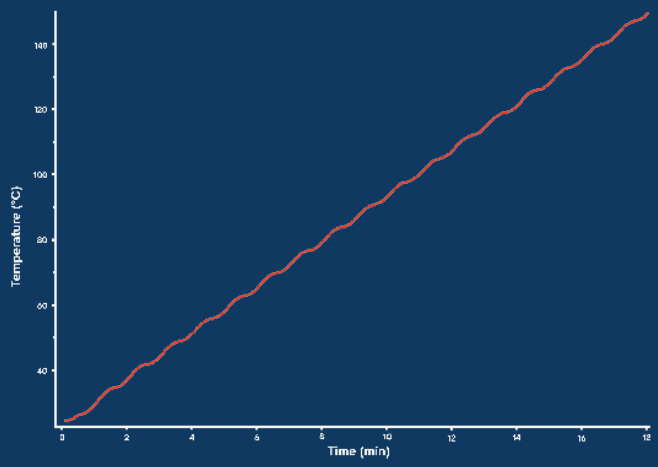
Conventional DSC measurements are based on a linearly increasing temperature profile and enable the analysis of thermal transitions such as melting or crystallization.

$T_s(t) = T_0 + b \cdot t$

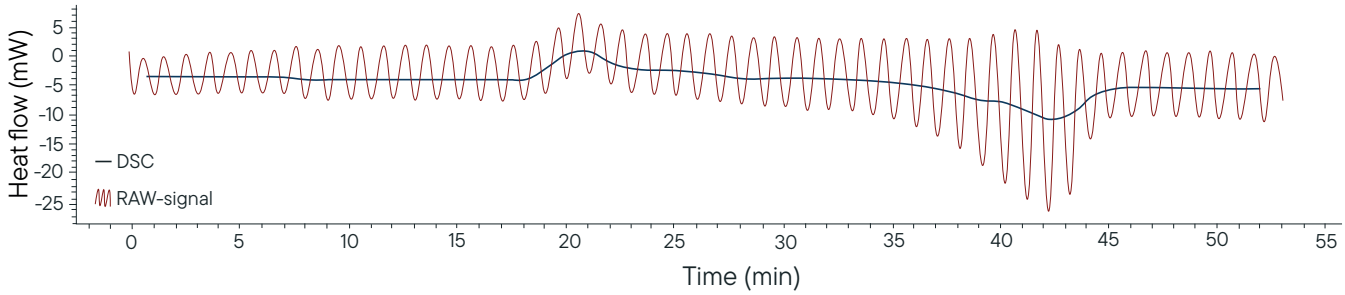


With modulated DSC, a sinusoidal modulation with a defined amplitude and period is superimposed on the linear temperature curve.

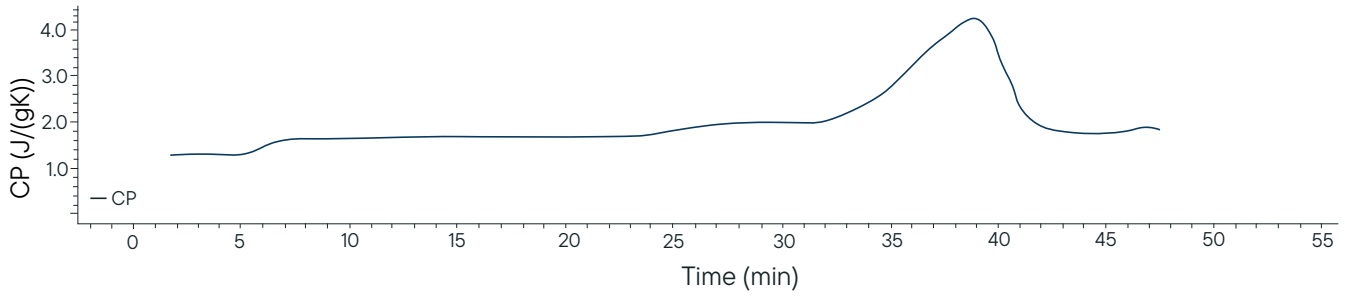
$T_s(t) = T_0 + b \cdot t + A_T \cdot sin(\omega \cdot t)$



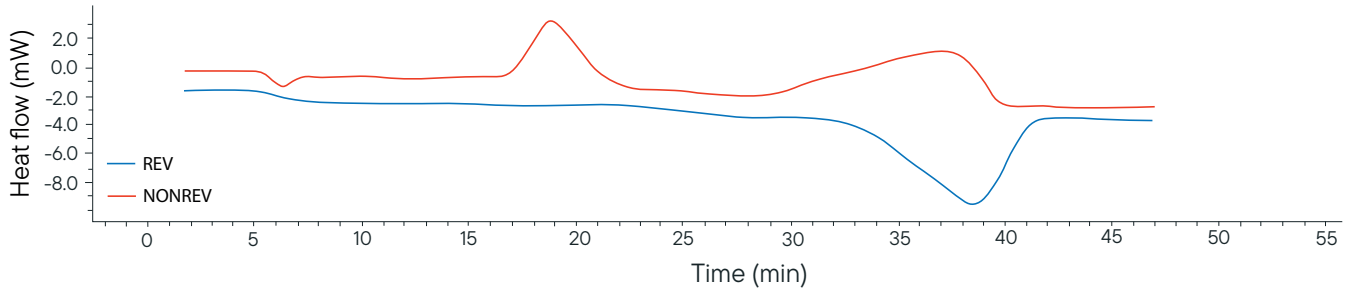
sample: **PET** reference material	heating rate: 5 K/min
weight: 18.7 mg	period: 60 s
temperatur: RT - 300 °C	amplitude: 1 K



The diagram above shows the difference between a conventional DSC measurement (dark blue) and the raw signal (red) of a modulated temperature applied to the same sample (PET).



The Cp signal, i.e. the specific heat capacity of the sample, can be derived from the measured raw signal. The diagram above shows thermal effects associated with structural changes in the sample, such as glass transitions or melting processes.



Temperature-modulated DSC measurements allow the total signal to be separated into reversible and non-reversible components. The reversible component (shown in blue) includes effects such as glass transitions and melting, while the irreversible component (shown in red) represents phenomena such as hysteresis peaks or cold crystallisation. This differentiation is only possible with temperature-modulated measurements.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Software

The software greatly enhances your workflow as the intuitive data handling only requires minimum parameter input. LiEAP offers a valuable guidance for the user when evaluating standard processes such as melting and crystallization points. The optional thermal library product identification tool, provides a database permitting an automatic identification tool for your tested materials such as polymers.

Data acquisition

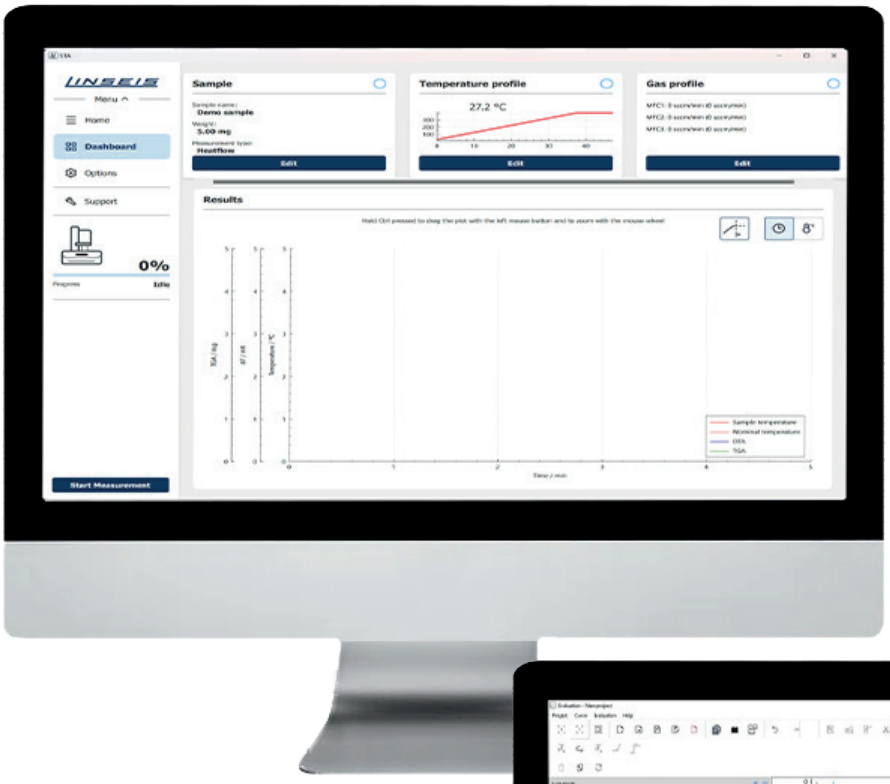
- **Shared database:**
  One software for many devices
- Compatible with the latest Windows® operating systems
- Online updates
- Automatic gas control for multiple gases and hardware types (optional)
- Unlimited heating, cooling and dwell time segments
- Multi-language versions such as English, German, French, Chinese, Japanese, etc. (User selectable)
- Optional password protection and user access levels
- Simultaneous data acquisition and evaluation

Data evaluation

- **Includes:**
  Signal correction and smoothing, derivate/integral, arithmetic operations for curves, peak evaluation, glass point evaluation, onset-point determination, multiple curve overlay, annotation and drawing tools, copy to clipboard function, multiple export features for graphic and data export, reference based correction.
- Undo and redo function for all steps
- Complete evaluation history
- Export to various data formats
- Extendable via Python plugins

DSC L63 Software

1) View of the evaluation software with two measurements and customizable toolbars



LINSEIS Data acquisition

LINSEIS Data evaluation

2) Start view of the measurement software with an overview of all relevant measurement parameters such as temerature profile, sample information, gas profile and the result diagram

Technical **Specifications**

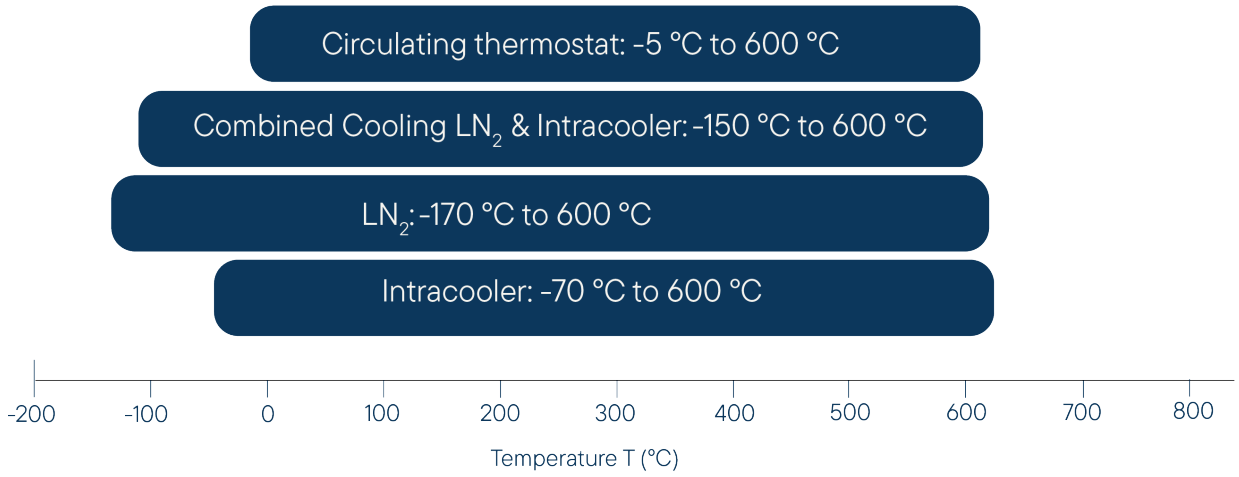
	Basic	Advanced
Heating rate	0.01 to 100 K/min	0.01 to 150 K/min
Cooling rate	Intracooler: 5 min (100 to 0 °C) LN_2: 10 min (100 to -100 °C)	Intracooler: 5 min (100 to 0 °C) LN_2: 10 min (100 to -100 °C)
Temperature range	-170 °C - 600 °C	-170 °C - 750 °C
User replaceable heatsink/cooling options	Yes	Yes
User replaceable furnace with sensors	Yes Furnace material: silver	Yes Furnace material: silver
Data capture	100 Hz	100 Hz
Temperature Accuracy	±0,1 K	±0,1 K
Enthalpy Precision	<1 % (Indium, Zinc)	<1 % (Indium, Zinc)
Measuring range	± 750 mW	± 750 mW
MFC (with 3 gases)*	Optional	Integrated
Unlimited warranty	Optional**	Optional**

* more gases on request
** In connection with a maintenance agreement

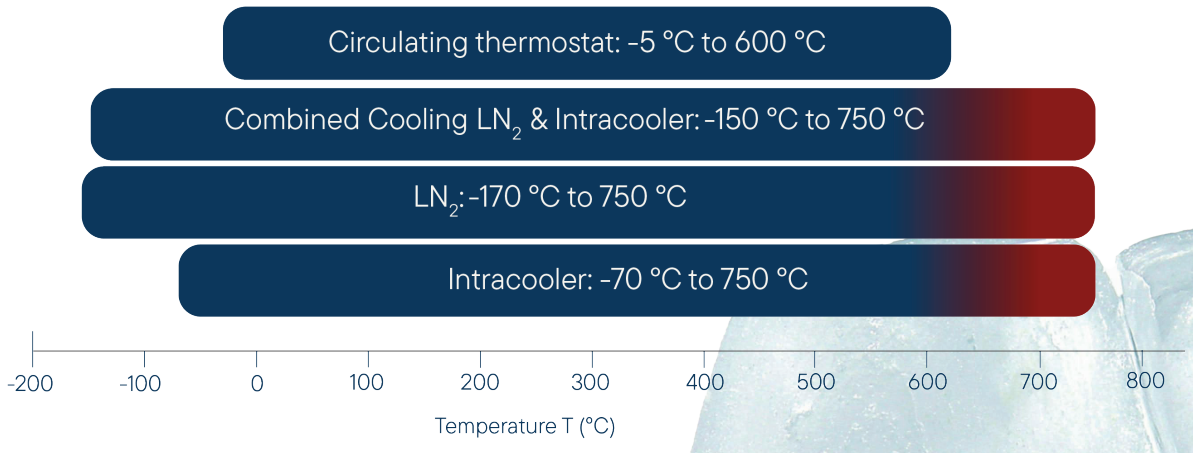
Cooling **Options**

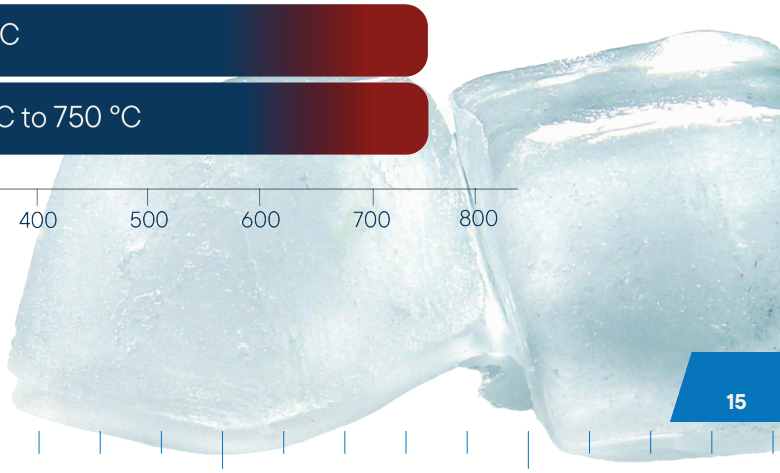
Discover the variety of our interchangeable cooling systems – for maximum flexibility in **LINSEIS DSC** applications.

DSC L63 Basic



DSC L63 Advanced



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Application Areas

Research

- Specific heat capacity
- Reaction kinetics

Food

- Melting behavior of fats
- Denaturation

Pharmaceutical

- Melting point
- Stability analysis

Polymers

- Glass transition
- Crystallinity

Metals

- Melting
- Solidification behavior

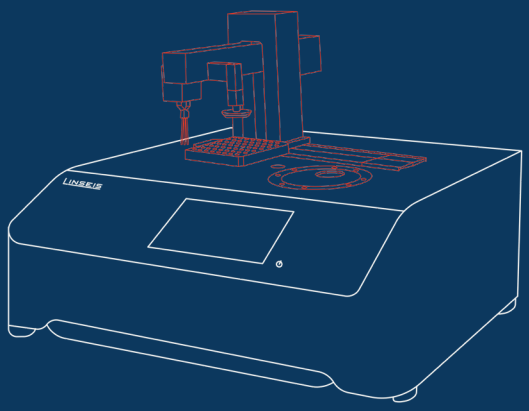
Electronics

- Thermal stability
- Curing

Hardware Options

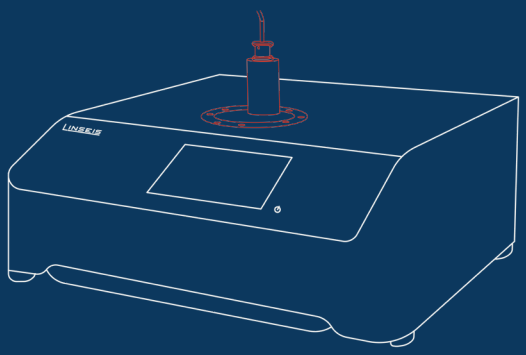
Sample Robot DSC

The sample robot for up to 90 samples increases the productivity significantly. The instrument can run automatically overnight or at the weekend. Together with the intuitive and intelligent software it reduces labour costs and saves time.



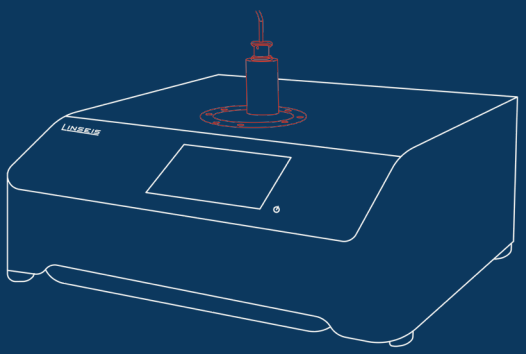
Optical DSC

The L63 DSC can be equipped with a CCD camera to observe the sample during the measurement. The visualization of the sample gives a much deeper insight to phase transitions and decomposition processes.



UV curing DSC

The Photo cell allows measurements under UV light to investigate UV curing systems. Due to the very short time constant, also fast UV curing reactions in the smallest time scale can be measured.



Service & Support

Crucibles

NAME	ORDER NUMBER	DESCRIPTION	PICTURES
Al Standard crucible 6x1,5mm 40µl	30293042	The most lightweight crucible and easy to use	
Al crimpable crucible 100µl	30293043	The biggest crucible for voluminous samples. Crimpable to measure with atmosphere	
Al crimpable crucible 40µl	30293045	The small crimpable crucible to measure with atmosphere	
Al lid without hole	30293044	Compatible with 30293043 and 30293045	
Al lid with hole	30293046	Compatible with 30293043 and 30293045	
Al crucible for foils with lid	30293050	Crimpable crucible to measure foils and powders. Special crimping tool is needed.	
Al crucible for small samples with lid	30293051 30293052	Crimpable crucible to measure small samples. Special crimping tool is needed.	
Cu crucible	30293049	The copper crucible to measure oxidation induction time and oxidation onset temperature	
High pressure crucible	20007024	Steel high pressure crucible enables the measuring under high pressure.	
Rhodium/Platin Scrucible with lid	PT087 PT082	The rhodium/platin crucible to measure the specific heat capacity.	
Al_2O_3 crucible 0,12 ml	200007018	Chemically inert universal crucible for higher temperature range	

Starter Kit

With every **DSC L63**, you receive a dedicated Starter Kit containing all essential components for immediate system operation. The kit includes tools for sample preparation, reference materials, and accessories for safe handling and initial calibration.
This ensures that you can begin generating reliable and meaningful measurement results from the very first use.

LINSEIS Starter Kit includes:

- Cutting tool
- Stainless-Steel tweezer
- PET grain - 3,5 mm
- Al Standard pan with lid
- Single-use syringes - 2 ml
- Single-use cannulas
- Glass sample vial - 10 ml

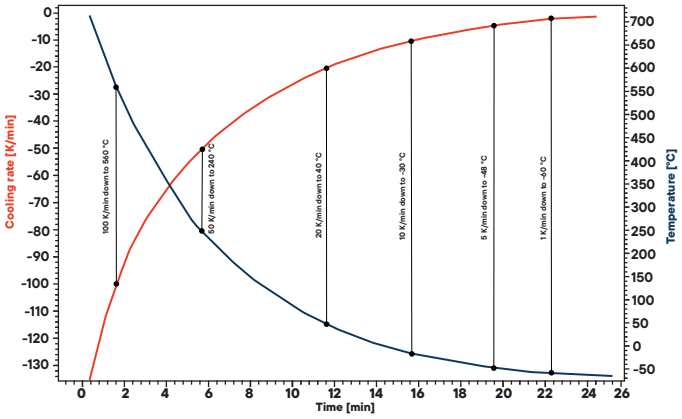
Linseis Shop

Applications

The new DSC system offers an innovative design with a wide temperature range from -70 °C to 750 °C, without having to adjust the cooling options. This allows a more efficient workflow by eliminating time-consuming adjustments. The instrument enables seamless transitions between low and high temperatures, making it ideal for demanding applications such as material research, polymer analysis, and quality control. With its high flexibility and user-friendly operation, this DSC sets a new standard for advanced thermal analysis.

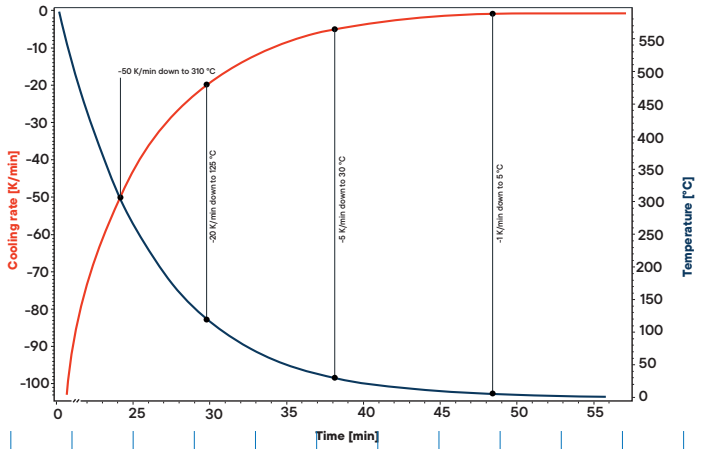
In the graphs you can see how the cooling options with and Intracooler and an circulating thermostat ensures efficient and rapid cooling.

Cooling rate with an Intracooler



Cooling rate	Down to
100 K/min	560 °C
50 K/min	240 °C
20 K/min	40 °C
10 K/min	-30 °C
5 K/min	-48 °C
1 K/min	-70 °C

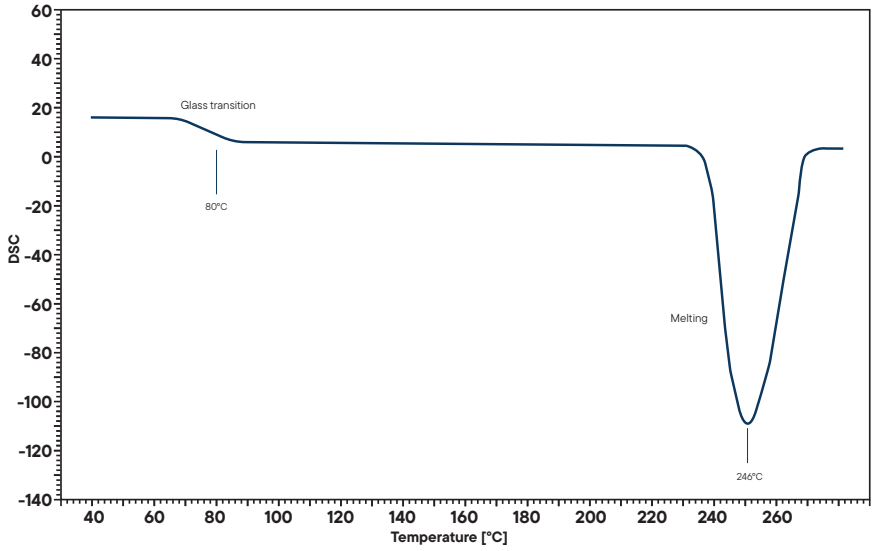
Cooling rate with an circulating thermostat



Cooling rate	Down to
50 K/min	310 °C
20 K/min	125 °C
5 K/min	30 °C
1 K/min	5 °C

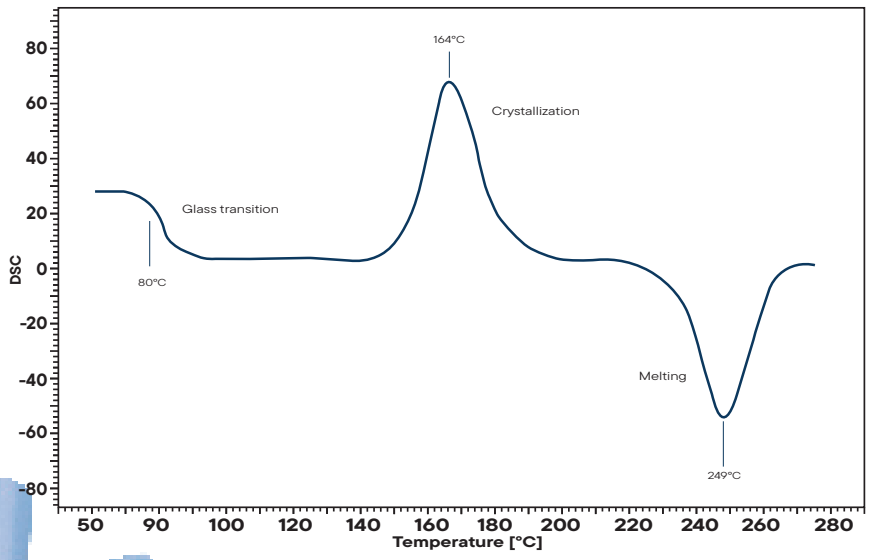
More applications

PET Granulate 1. Heating



The analysis of polymers is one of the main applications of DSC. Effects such as glass transitions, melting and crystallization are of interest and sometimes hard to detect. The new LINSEIS L63 DSC offers high resolution and sensitivity, making it an ideal instrument for this type of analysis. With its innovative design, it is now possible to analyze important properties of the sample even during the initial heating of the PET granulate at a linear heating rate of 20 K/min. The curve shows a significant glass transition around 80 °C, followed by a melting peak at 246°C.

PET Granulate 2. Heating



Depending on the cooling rate, the degree of crystallinity of the polymer changes significantly. During a subsequent heating run, cold crystallization can be observed with a linear heating rate of 20 K/min. The curve reveals a distinct glass transition at around 80 °C, followed by cold crystallization of the amorphous regions starting at approximately 148 °C and a melting peak starting at 230 °C. This allows the complete characterization of the sample with just two heating cycles.

LINSEIS

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