LINSEIS

pushing boundaries

IBC L91

Isothermal Battery **Calorimeter**

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.

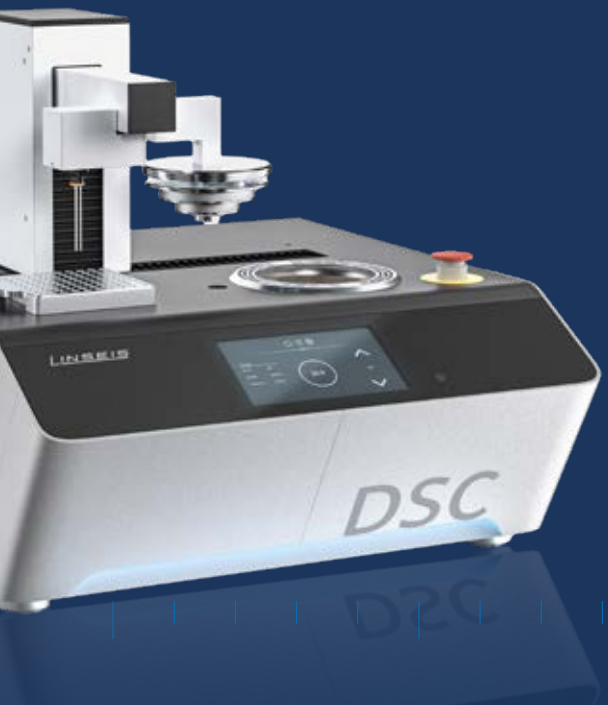
CLAUS LINSEIS

CEO DIPL. PHYS.

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.



Isothermal Battery **Calorimeter**

A battery calorimeter is a device for measuring the heat generated by a battery during charging and discharging. This measurement is referred to as „heat of reaction“ and is an important indicator of a battery‘s performance. The heat of reaction is the difference between the enthalpy (heat content) of the reactants and the products of a chemical reaction.

Battery calorimeters are used in research and development to evaluate new battery chemistries and optimize the design of existing batteries. They are also used in the manufacturing process to ensure that batteries meet performance and safety standards.

LINSEIS offers a modular **Isothermal Battery Calorimeter (IBC)** for the thermal monitoring of batteries. It consists of a variable number of almost identical components and enables the investigation of a wide range of battery cell sizes. The geometry of the modules is also easily scalable.

Importance of the battery calorimeter: The battery calorimeter measures the amount of heat generated during electrochemical reactions within the battery. These measurements are crucial for understanding and improving the thermal behavior and efficiency of batteries.

Areas of application: These devices are particularly important for the development of new battery types, such as lithium-ion batteries, where thermal stability and safety are of paramount importance. They are also used in quality control and performance testing of batteries.

Thermal analysis and safety: By analyzing heat generation under different operating conditions, battery calorimeters help to identify and prevent potential safety risks such as thermal runaway. This is crucial for the safety of end-user products.

Optimizing battery performance: Accurate measurement of heat generation allows the internal chemistry and design of the battery to be optimized, resulting in increased energy density, improved charge capacity and longer life.

Research and development: Battery calorimeters are used in research and development laboratories to test and evaluate new materials and technologies. The resulting findings are essential for progress in battery technology.

Specifications

Measurement cell	
Measurement plate	80 x 80 mm 300 x 300 mm 600 x 600 mm others on request
Sample height	up to 100 mm
Measurement range	max. 10 W (for 80 x 80 mm measurement plate)
Calorimetric resolution	0.1 mW
Calorimetric accuracy	0.5 mW
Temperature dimensional resolution	8 Sensors (for 80 x 80 mm measurement plate)
Additional temperature sensors	available on request
Heat Flow dimensional resolution	8 Sensors (for 80 x 80 mm measurement plate)
Cell adapters	available for 14500, 18650, coin cel, on request
Sampling rate	up to 10 Hz
Calibration	build in automatic calibration procedure, calibration heater
Noise	0.015 mV
Ambient Conditions / Temperature options	
Temperature range	-40 °C up to 140 °C
Temperature stability	0,01 K
Temperature resolution	0,0001 °C
Temperature accuracy	0,001 °C
Electrical Specification	
Power supply	AC 230 V / 50 Hz
Maximum power consumption	120 W (main device)
Display	Yes
Charging current	depending on customer choice
Charging voltage	depending on customer choice
Discharging voltage	depending on customer choice
Battery charges	on request
Laboratory power supply	on request
Software	Linseis Platinum Software (free)
Software features	auto calibration mode, Heat Flow Correction, powerful Evaluation Software with calorimetric tools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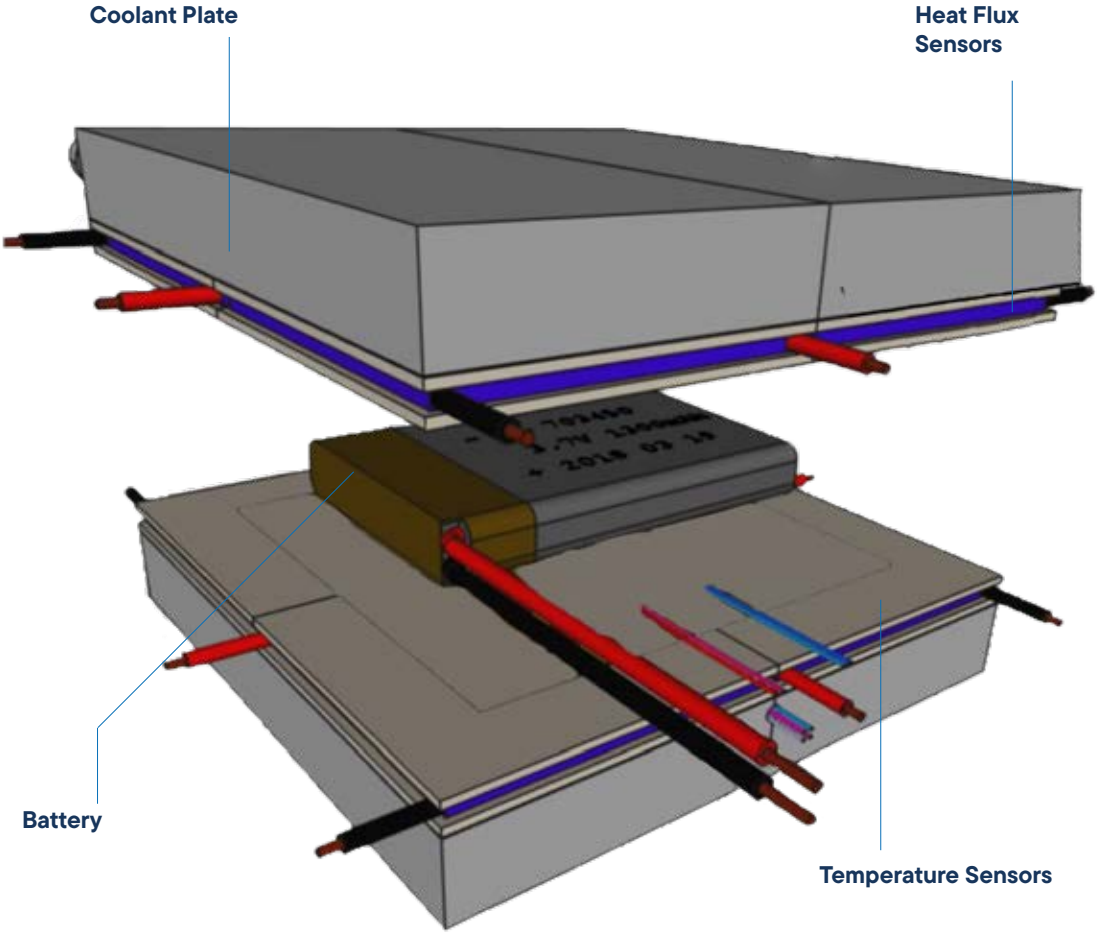
Hardware

The IBC L91 works with two measurement plates as a calvet type calorimeter with eight Heat Flux sensors and ten temperature sensors in the smallest configuration (80 mm x 80 mm).

The layout gives the ability to realize stable ambient conditions and minimum losses for each sample type. The measurement cell is avaiable in 80 mm x 80 mm, 300 mm x 300 mm, 600 mm x 600 mm as well as customzed layout to our customers needs.

Furthermore the open access design gives the ability to run the charging and discharging process with every charger, Load or power supply. Measurement data and protocolls can by imported to Linseis Platinum Software for combined evaluation and correlation of electrical and thermal behavior of batteries.

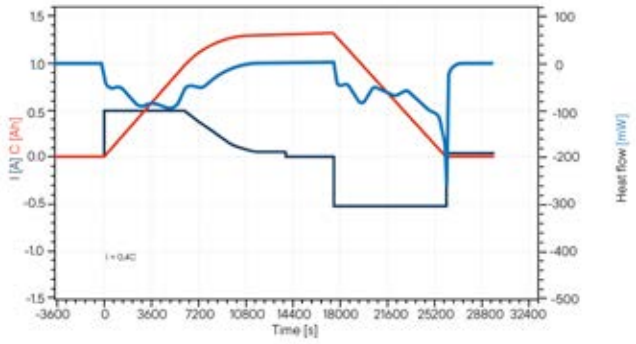
Besides the Plate design also adapters for round cells (18650, 14500 ...) as well as coin cells are avaiable.

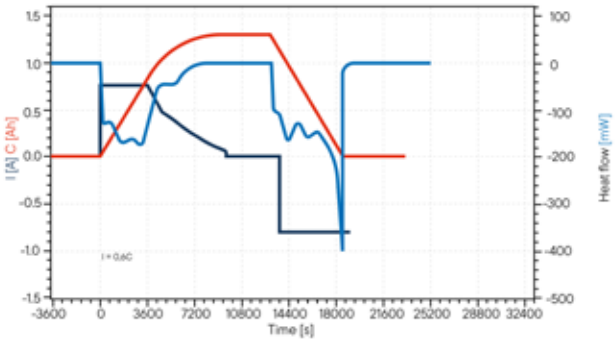


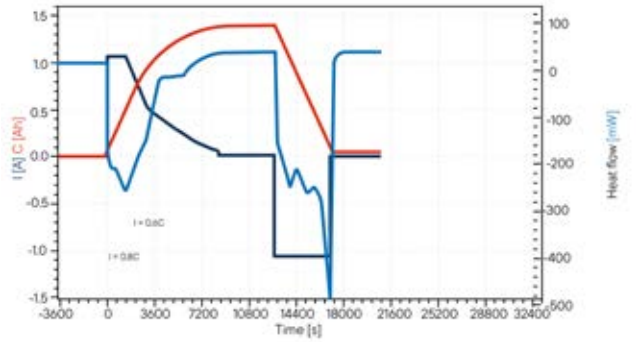
Applications
IBC L91

Linseis IBC L91 gives the ability to deeply investigate batteries

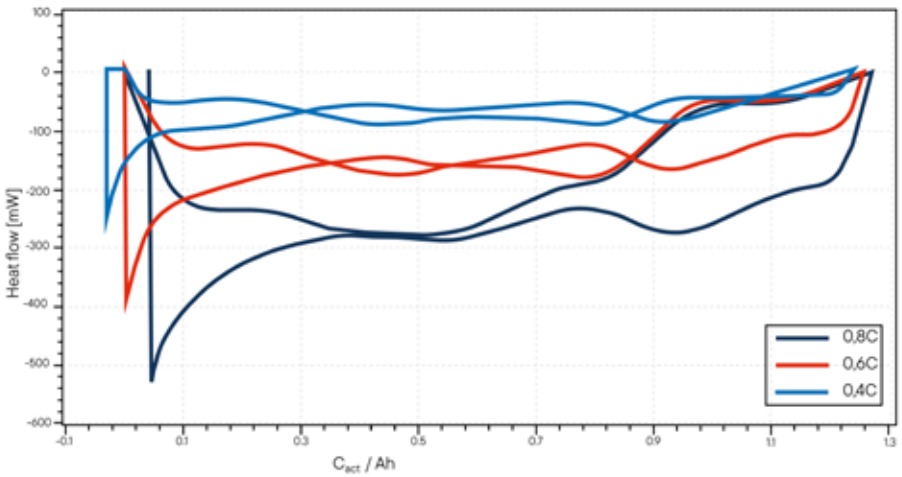
- Under different temperature conditions
- For aging behavior
- For efficiency level of cell and electronics
- For various battery types
- For various cell formats (pouch, coin, round, boxed ...)
- For phase changes during usage







Heat flow across the capacity of a 1-cell Li-ion standard battery at different charge and discharge currents. This allows conclusions to be drawn about the stress on a battery during charging or discharging. For example, the cell voltage, charge and discharge current, and the correlating heat flow from the sample can be displayed. In addition, other relevant information such as the transferred charging and discharging power and temperature of the battery can be displayed, analyzed and documented.



Heat flow over the capacity of a 1-cell Li-ion standard battery at different charge and discharge currents. This allows differences in the efficiency of various charging parameters to be displayed depending on the capacity of a battery. What is striking here, for example, is the different residual capacity depending on the different discharge parameters. A significant increase in heat flow at higher charging and discharging currents is also evident.

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