



Product Catalog 2025

# Superior hardware and software tools

for mastering electrochemical  
research and experiments



High Quality Tools.  
Reliable Data.  
Deeper Insights.  
**Create the next.**

Superior hardware and software  
tools for mastering electrochemical  
research and experiments



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# rh*d* instruments.

## Your electrochemistry partner

Since 2013, our team at rh*d* instruments has been working on the development of high-quality test cells and powerful software packages focusing on facilitating and accelerating electrochemistry experiments.





# Our mission

We combine know-how with a passion for innovation to deliver high-value laboratory equipment and software. Our goal is to accelerate and standardize research in the energy storage and conversion field.

## Our philosophy

We believe that you get the best results when you can do something you are passionate about. That is why our team members can focus on tasks they really like to do. As a result, we can provide our customers with high-quality innovative products and services.

We follow a customer-centric approach: We take the time to understand your requirements and problems in detail and to find the best solutions together with you. At rhd instruments you get individually tailored solutions and advice based on our team member's experience.

## What makes us unique?



We take the time to understand your individual needs.



We continuously accompany you during a product's lifetime with our advice.



We can customize our products according to your requirements.



We use only high-quality materials and work together with selected suppliers to guarantee the highest level of quality.



# A few numbers and facts

**45+ countries**

So far, more than 800 customers value our products and services. 40% of them are companies and 60% are research institutes or universities. Our products are currently in use in more than 45 countries.

**rhd - 3 letters**

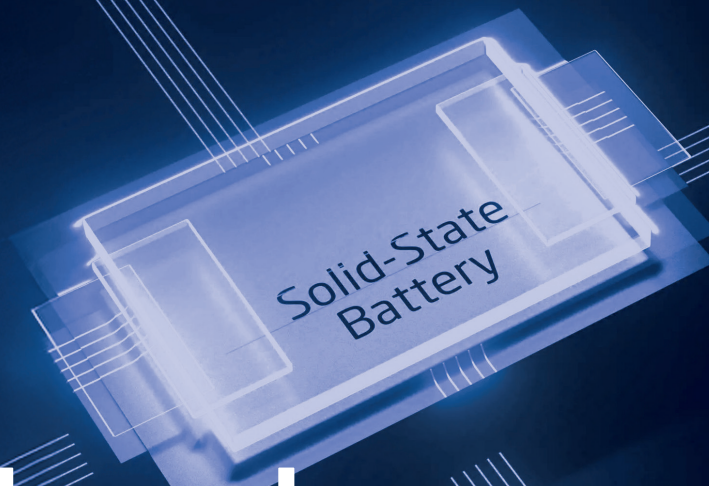
"rhd" stands for Roling, Huber, Drüschler. Prof. Dr. Bernhard Roling was the group leader and supervisor of Benedikt Huber and Marcel Drüschler during their time as PhD students at the University of Marburg. In gratitude for his support and for giving them the chance to focus on test cell development besides performing the experimental work, the first letter of his surname was included in the company name.

**10+ years**

rhd instruments was founded in 2013 at the University of Marburg by Benedikt Huber and Marcel Drüschler. They both worked with ionic liquids during their time as PhD students. Since ionic liquids were very expensive, they had to develop small air-tight test cells for electrochemistry experiments which were not existing on the market. This was the beginning of the rhd instruments story.

**800+ single parts**

The simplest product consists of only 2 parts, the most complex one of more than 800 single parts.



# Test cells and pressure frames

## for testing solid-state batteries, solid electrolytes and pouch cells



### Standardization

Benefit from standardized test cells enhancing the level of reproducibility and robustness, and ensuring an optimal inter-comparability of results between different laboratories.



### Precision

Enjoy working with high-precision electrochemical equipment enabling you to perform even very challenging experiments.



### Quality

All parts are made of premium materials and are the result of the highest level of craftsmanship and engineering - a very good basis for generating high-quality data in testing solid-state batteries and electrolytes.



### Automation

Very powerful and user-friendly software packages help you to automate your experiments, including all routine steps.



## Solid-state test cells

Air-tight test cells based on an innovative design for 2- or 3-electrode characterization of solid-state batteries and solid-state electrolytes.

## Pressure frames

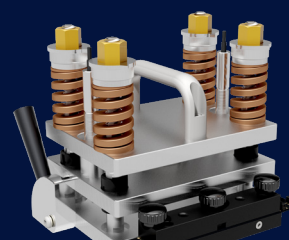
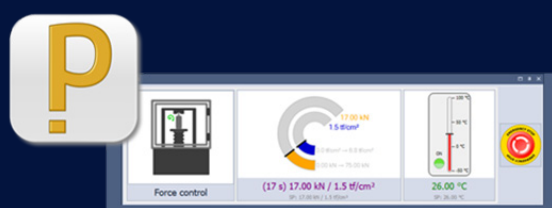
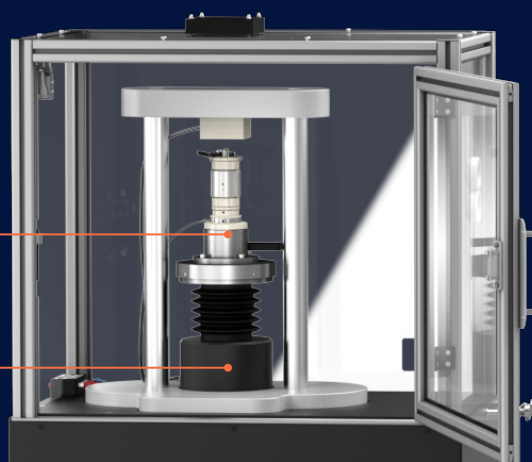
Frames for precisely adjusting the sample stack pressure, with the option to simultaneously adjust the sample temperature.

## Software for automated measurements

Software for automated measurements including synchronization of electrochemical measurements with pressure and temperature adjustment.

## Fixtures for testing pouch cells

Innovative fixtures for testing pouch cells at different pressures and temperatures, incl. thickness monitoring.



## Pressure Frames .....10



## Test Cells and holders (CD/CF) .....18



## Accessories..... 24

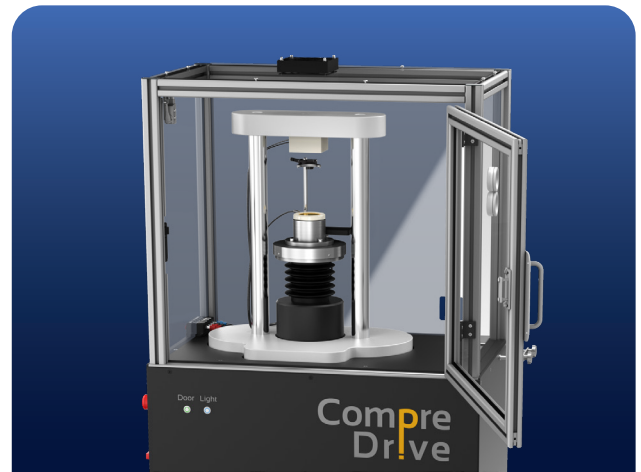


# Compre-Drive

## Automated testing station for solid-state batteries and pouch cells

Benefit from this unprecedented setup to operate test cells in solid-state battery and solid electrolyte research, and to precisely study batteries of all chemistries in a pouch cell format under various conditions.

- High-precision pressure and temperature regulation
- Broad accessible stack-pressure and temperature range
- Designed for Innovative test cell and fixture concepts covering various sample sizes, starting from coin-cell sized samples up to small pouch cell formats
- On-demand: dilatation measurement, e.g. during cycling of pouch cells
- Powerful, trend-setting control software ensuring fully automated test procedures



## Typical applications

This powerful setup can be used for many different applications and offers a high degree of automation:

- Cycling of solid-state batteries and pouch cells under active pressure and temperature regulation
- Determination of the temperature-dependent solid electrolyte conductivity
- Dilatation monitoring while cycling pouch cells

*„Finally, I found the perfect device for testing solid-state batteries.“*

**Head of R&D**

## Detailed description

The CompreDrive is the first testing station of its kind for the investigation of solid-state batteries, solid electrolytes and all kind of battery chemistries in a pouch cell format that allows for active pressure regulation and monitoring.

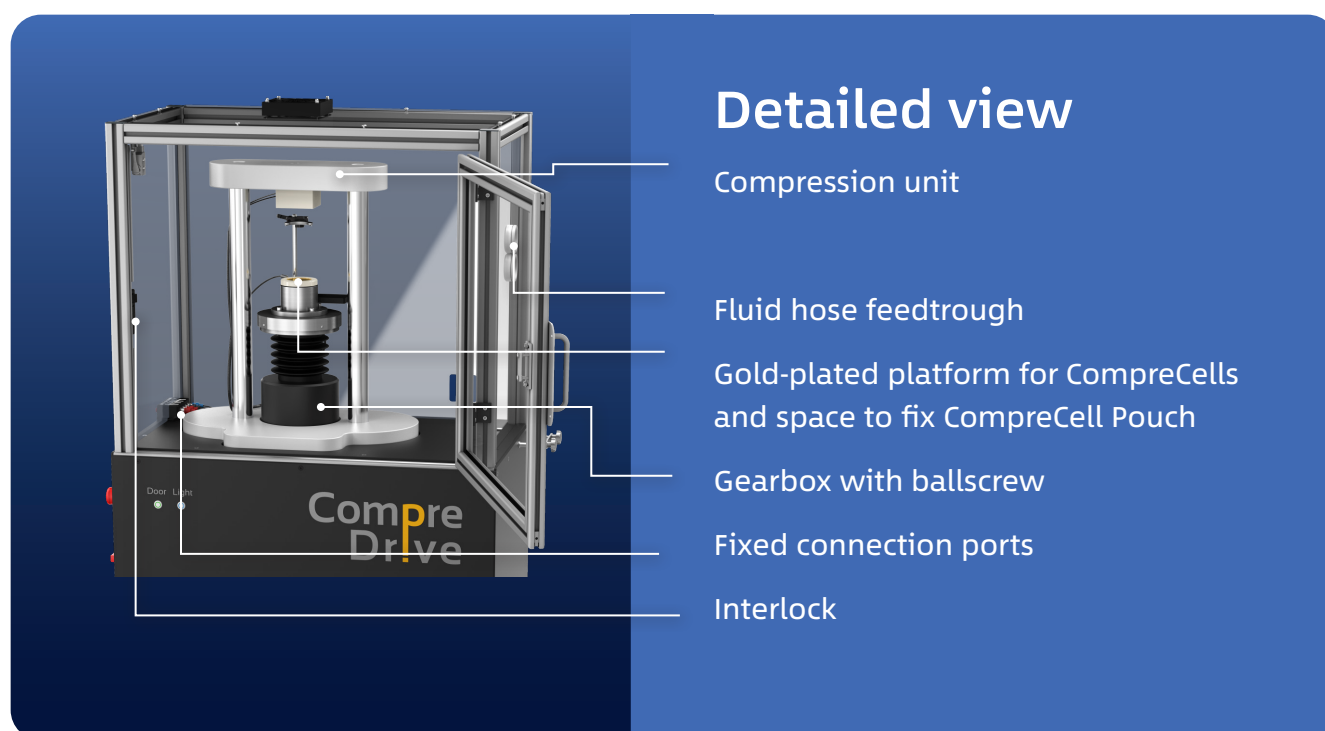
Uniaxial forces up to 75 kN can be applied and kept constant on the sample with



unprecedented accuracy by the active force regulation system. The CompreDrive uses an ultra-high resolution servo drive for force regulation instead of a hydraulic system. This allows for high positioning speeds with a minimum step width of <10 nm. In case of solid-state batteries and solid electrolytes, the sample is placed inside a fully sealable, specialized measuring cell (CompreCell or CompreCell DP), which enables the handling of air-sensitive samples. Also, small pouch cells can be handled by using the Compre-

Cell Pouch fixture. Temperature regulation can be achieved by adding the H-Addon or the HC-Addon. The HC-Addon requires an external circulating thermostat.

The included powerful software CompreDriveControl allows for an interconnection of thermocontroller/analyser software/CompreDrive, which enables individual, automated procedures.



## Selected technical specifications

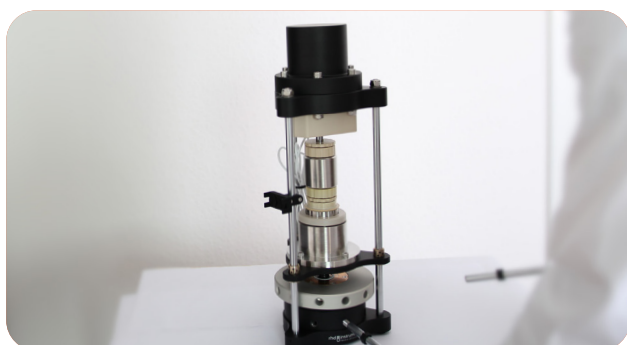
<b>Max. force</b>	75 kN
<b>Min. force</b>	0.03 kN or 0.15% of force sensor full scale whichever is higher
<b>Available force sensors</b>	100 kN, 10 kN, 2 kN
<b>Accessible temperature range</b>	-30 °C ... +230 °C (HC-Addon *) or RT ... +250 °C (H-Addon); limited by sleeve material and selected thermostat model  *Requires external circulating thermostat
<b>Rated dimensions</b>	0.6 m x 0.8 m x 1,7 m (L x W x H)
<b>Weight</b>	approx. 180 kg

# Compre-Frame

## Pressure frame for testing solid-state batteries and pouch cells

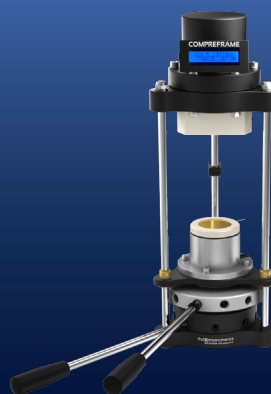
Get to know the CompreFrame, the little brother of the CompreDrive: Benefit from a versatile setup to operate test cells for researching solid-state electrolytes and solid-state batteries as well as to test pouch cells under pressure and temperature control.

- Precise manual pressure adjustment and temperature control
- Broad accessible stack-pressure and temperature range
- Designed for innovative test cell and fixture concepts covering various sample sizes, starting from coin-cell sized samples up to small pouch cell formats



*„I love that versatile fixture for testing my pouch cells.“*

**Quality Control Engineer**



## Typical applications

- Cycling of solid-state batteries or pouch cells at precisely adjusted stack-pressures and under active temperature control
- Pressure- and temperature dependent investigation of a solid electrolyte's conductivity
- Stripping-plating experiments at different pressures and temperatures

## Detailed description

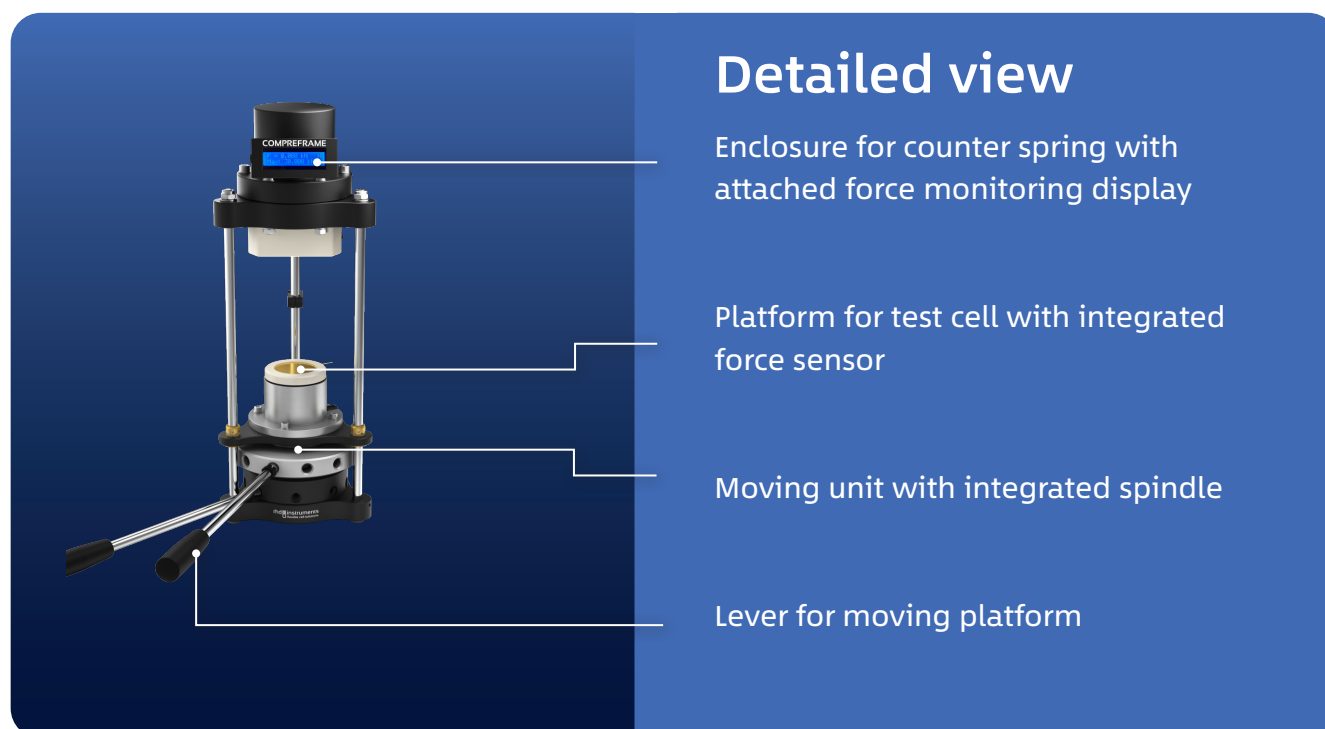
The CompreFrame is a pressure frame for all types of CompreCells (CompreCell, CompreCell DP and CompreCell Pouch) enabling very precise manual pressure application to solid electrolyte powders and pellets, solid-state batteries, and pouch cells.

A display unit always shows the current force, making stand-alone operation possible. The force and sample temperature can also be recorded and monitored using the included CompreDriveControl software.

The CompreFrame offers automated temperature control, if used with the optional accessories H- or HC-Addon.



Different pressure sensors are available for best accuracy. If other spring assemblies should be required, please contact us to discuss customization options.



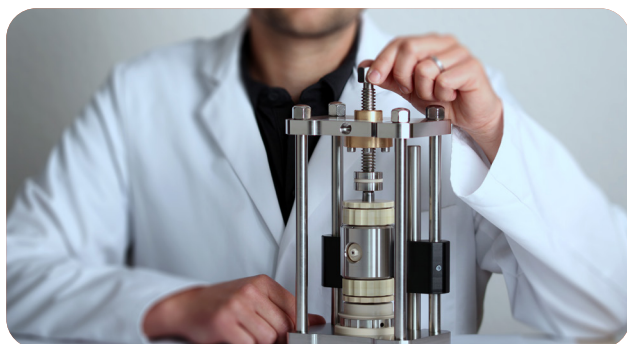
## Selected technical specifications

<b>Max. force</b>	32 kN
<b>Torque needed for max. force</b>	50 Nm for 30 kN
<b>Min. force</b>	0.3 kN
<b>Available force sensors</b>	100 kN, 10 kN, 2 kN
<b>Optional accessories</b>	-30 °C ... +230 °C (HC-Addon *) or RT ... +250 °C (H-Addon); limited by sleeve material and selected thermostat model *Requires external circulating thermostat
<b>Rated dimensions</b>	19.2 cm x 19.0 cm x 51.4 cm (L x W x H)
<b>Weight</b>	approx. 16.5 kg

# ComPrep

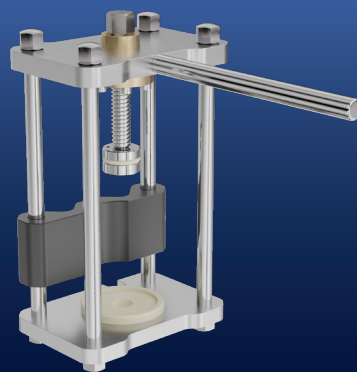
## Small pressure frame for studying solid-state batteries

- Compatible with all types of cylindrical CompreCells
- Torque-based force application
- Electrically insulates the test cell, offers 2 mm and 4 mm female connectors
- Parallelize your measurements



*„Perfect size for my temperature chamber experiments.“*

**R&D Scientist**



## Typical applications

Prepare your CompreCells for use in CompreDrive or CompreFrame, or use the ComPrep directly as preparation and pressure frame. Directly connect a potentiostat.

- Pre-pressing of powder materials in CompreCells in a glove box
- Easy and reliable removal of pressed pellets from CompreCells
- EIS or cycling of CompreCells under pressure in temperature chambers (solid-state battery cycling, solid electrolyte conductivity determination, determination of the critical current density, ...)

## Detailed description

The ComPrep is compatible with the CompreCell and the CompreCell DP as well as the three electrode options.

It is a manually operated pressure frame that comes with a torque wrench. The combination of a high-precision trapezoidal spindle and bearing bronze ensures a reliable and reproducible torque-based force application.

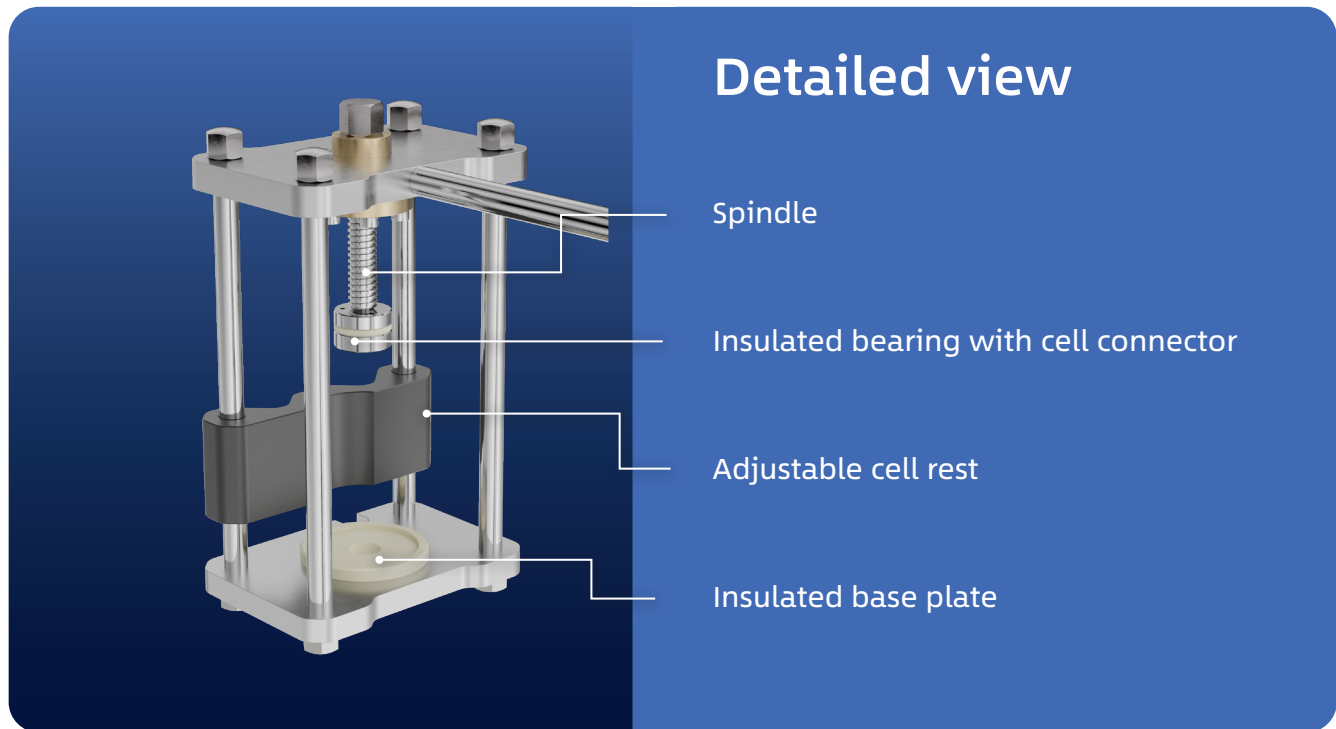


The optimized footprint and the compliance temperature range makes it the ideal solution for testing of many cells in parallel.

As a single unit, it fits every budget.

The electrochemical device (cycler, potentiostat, impedance analyser) can directly be

connected to the ComPrep and the Compre-Cell using banana connectors.



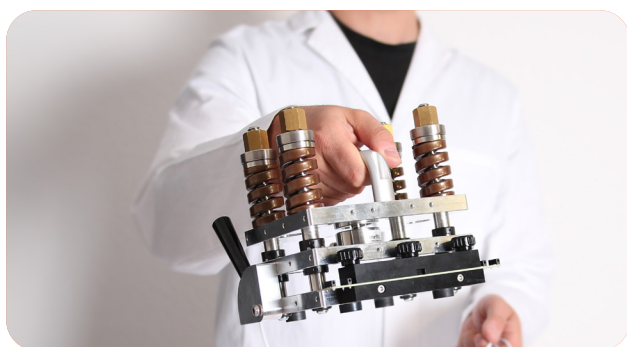
## Selected technical specifications

<b>Max. applicable force</b>	23 kN
<b>Temperature range (in temperature chamber)</b>	-40 °C ... +100 °C
<b>Torque needed for max. force</b>	40 Nm for 23 kN
<b>Rated dimensions</b>	25 cm x 14 cm x 10 cm (L x W x H)
<b>Total weight</b>	4.4 kg
<b>Special feature</b>	Stackable

# Compre-Pouch

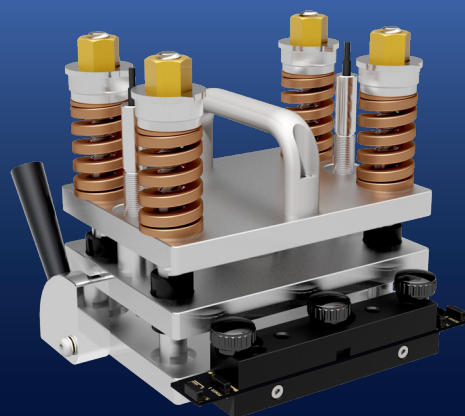
## A versatile stand-alone pouch cell fixture

- Switch between pseudo-constant volume and spring-loaded mode
- Follow pressure and thickness changes during cycling
- Large accessible pressure and temperature range
- Small foot-print and low height: Parallelize your measurements
- 2D pressure mapping in combination with e.g. TekScan sensors
- Switch between pseudo-constant volume and spring-loaded mode



*„We increased the number of specimens under test, while still monitoring all essential values.“*

**Laboratory Head**



## Typical applications

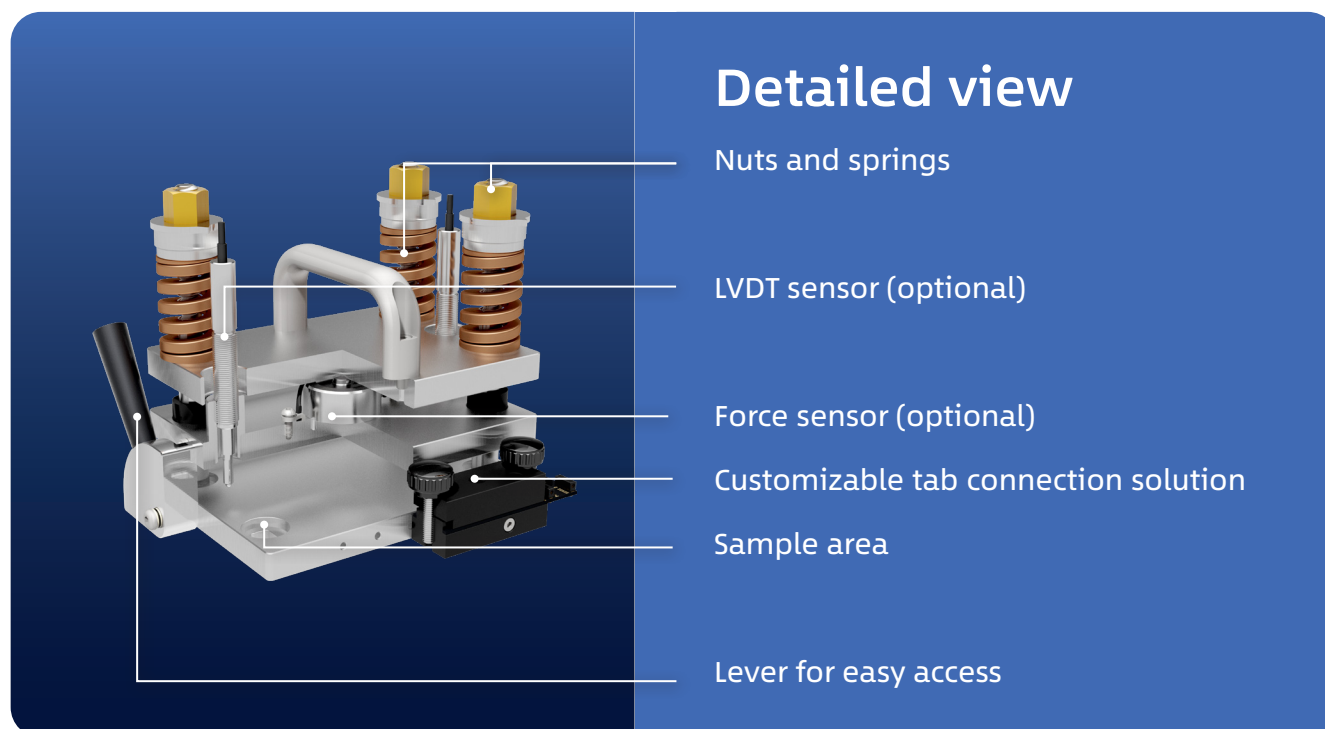
- Cycling of pouch cells at spring-loaded stack-pressure, mimicking flexible installation situations
- Cycling of pouch cells at pseudo-fixed volume, mimicking constrained installation situations
- 2D pressure mapping while cycling at different conditions
- Quantifying pouch cell breathing and swelling during cycling
- Improving reproducibility by well-controlled measurement conditions

## Detailed description

The ComprePouch is a cell fixture that enables electrochemical tests of batteries in a pouch cell format at different stack-pressure conditions. It allows for switching between pseudo-constant volume and spring-loaded pressure conditions. As an option, it integrates a force sensor, that shows the applied force on an attached display and/or a connected PC. Further options include precise in-situ thickness measurements allowing for a cell breathing and swelling

analysis in the spring-loaded mode. Force is applied by four nuts compressing tension springs. Force is transferred through massive, guided metal plates, and optionally a force sensor, to your sample. The springs can easily be exchanged by ones with different rates or stiff cylinders.

The measured force can be shown on a display and/or monitored and stored via a connected PC. You can use all data handling and plotting features that our CompreDrive-Control software offers. The sample temperature can be controlled by placing the ComprePouch inside a temperature chamber.



## Selected technical specifications

<b>Max.sample dimensions</b>	120 mm x 110 mm x 20 mm
<b>Max. force</b>	25 kN
<b>Temperature range</b>	T <sub>operation</sub> = -30 °C ... +90 °C T <sub>operation</sub> LVDT = -20 °C ... +85 °C
<b>Max. measurement potential</b>	40 V ac/dc
<b>Max. measurement current</b>	5A (using integrated tab connection)
<b>Rated dimensions</b>	ComprePouch: 189 mm x 146 mm x 173 mm Force monitoring electronics: 140 mm x 106 mm x 60 mm
<b>Typical weight</b>	4.6 kg



# Compre-Cell

## Test cell for solid electrolytes

Benefit from this air-tight and robust test cell for solid electrolyte testing. The test cell shows outstanding features:

- Broad pressure and temperature range
- Air-tight concept suitable for moisture- and air-sensitive samples
- User-friendly design and easy handling



*„The CompreCell helped my team to get reliable conductivity data for our solid electrolyte. “*

**Lab Manager R&D**



## Typical applications

The CompreCell can be used to parametrize solid electrolytes or test solid-state batteries starting from powders or pellets.

- Pressure- and temperature-dependent investigation of a solid electrolyte's conductivity
- Cycling of solid-state batteries under active stack-pressure and temperature regulation
- Stripping-plating experiments at different stack-pressures

## Detailed description

The CompreCell is compatible with the CompreDrive, CompreFrame and ComPrep setup. The CompreCell is used in solid-state electrochemistry to investigate materials such as solid electrolytes or solid-state batteries with common electrochemical methods while keeping the sample under defined compression and temperature.

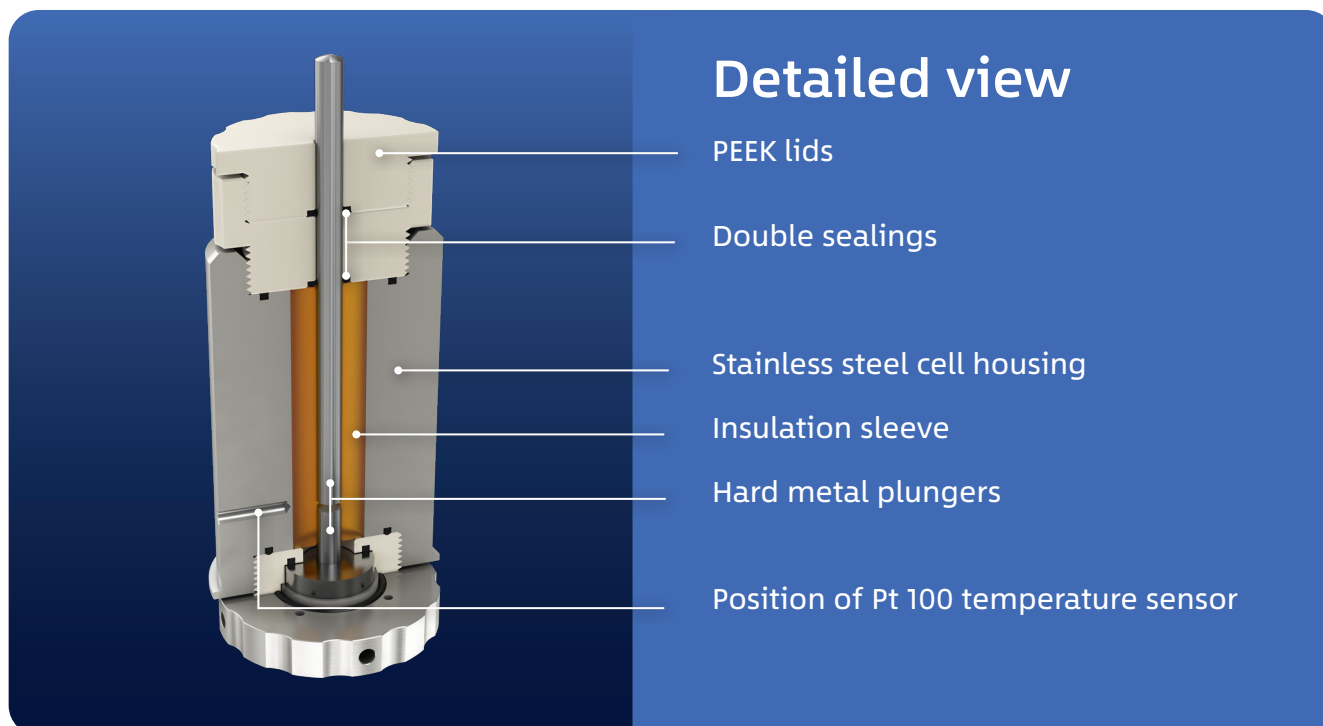
The CompreCell is airtight (helium-leakage tested up to +250 °C!) and can therefore be used to handle sensitive samples by filling the cell in a glovebox under inert gas atmosphere and then performing the

measurements outside.

The force is applied via hard-metal plungers that are inserted into an inner sleeve that is commonly made from an AlO<sub>x</sub>-ceramic for maximum force resistance. The sleeve may also be manufactured from other materials such as PEI or PEEK, which may limit the

maximum temperature that may be applied to the cell.

The default sample diameters are 12 mm, 10 mm or 6 mm, but other diameters might be available on demand. Likewise, the maximum force may be limited, due to the increased pressures produced at smaller diameters.



## Selected technical specifications

<b>Temperature range (operation)</b>	$T_{\text{operation}} = -40\text{ °C} \dots +150\text{ °C}$ (PEEK sleeve) / $+200\text{ °C}$ (PEI sleeve) / $+250\text{ °C}$ (Al <sub>2</sub> O <sub>3</sub> sleeve)
<b>Plunger diameter</b>	6 mm, 10 mm or 12 mm
<b>Piston material</b>	Hard metal (90% Tungsten carbide, 10% Cobalt)
<b>Max. applicable force</b>	$F_{\text{max}} = 75\text{ kN}$ (10 mm, 12 mm piston) / $50\text{ kN}$ (6 mm piston)
<b>Total weight</b>	approx. 1.8 kg
<b>Rated dimensions</b>	6 cm x 6 cm x 14 cm (L x W x H)

# Compre-Cell DP

## Test cell for solid-state batteries

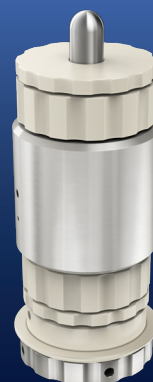
Benefit from this air-tight test cell for solid-state battery testing (2-and 3-electrode testing with „3e“ option). The test cell shows outstanding features:

- Broad temperature and pressure range
- Optimized for layer-by-layer assembly of solid-state batteries
- Air-tight concept suitable for moisture- and air-sensitive samples



*„A must have for all people working on solid-state batteries “*

**CTO**



## Typical applications

The CompreCell DP is the ideal solution for the layer-by-layer assembly of solid-state batteries and allows for studying them in a 2- or 3-electrode configuration at different stack-pressures and temperatures:

- Cycling of solid-state batteries under active stack-pressure and temperature control
- Pressure- and temperature-dependent investigation of a solid electrolyte's conductivity
- Stripping-plating experiments at different stack pressures

## Detailed description

The CompreCell DP is compatible with the CompreDrive, CompreFrame, and ComPrep setup. It is airtight and can be used to handle air- and moisture-sensitive samples.

An intuitive design facilitates the layer-by-layer assembly of an solid-state battery starting from the separate component materials: Both hard metal plungers in the cell can move independently and therefore apply pressure to a stack at a fixed position in the inner sleeve. This allows for measuring sample stacks that are sensitive to ver-

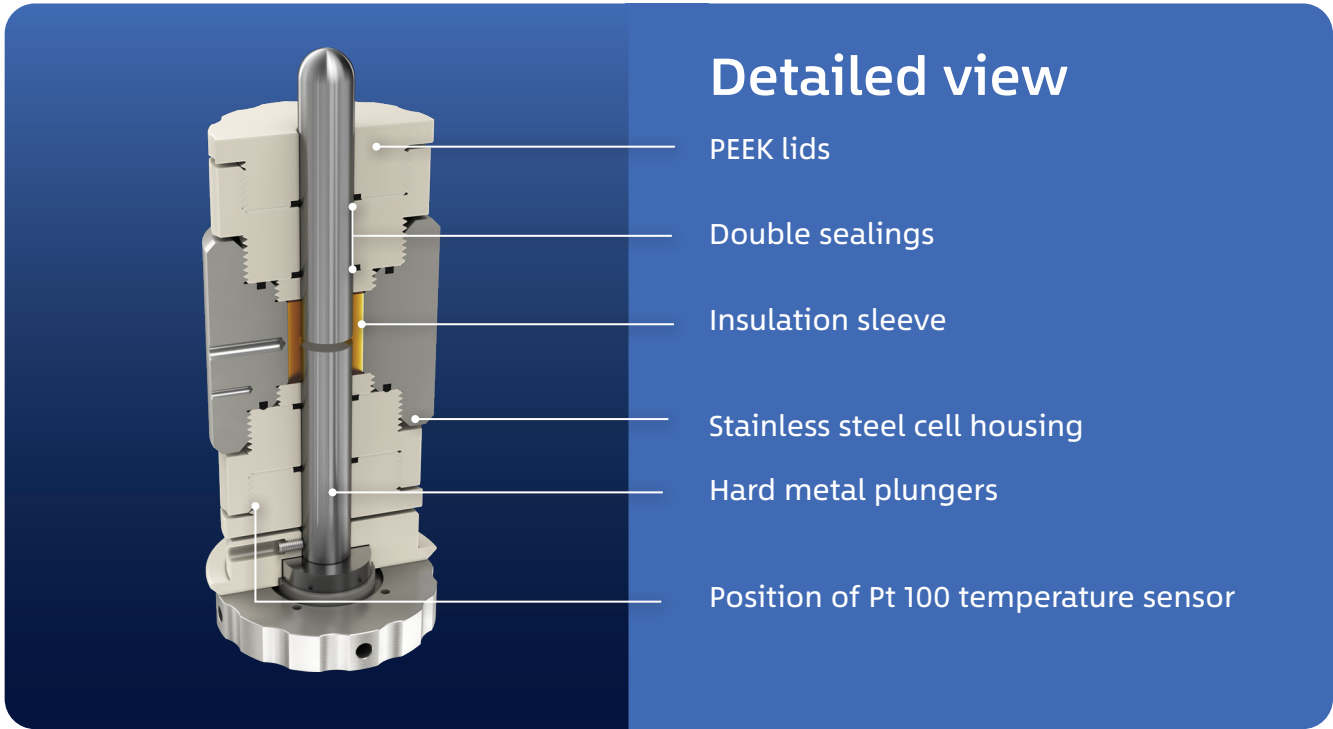


tical movement and minimizes the risk of cracking and creating short-circuits through the layers.

As sleeve material, AlOx, PEI, and PEEK are available. The fixed location of the sample also facilitates the use of a solid-

state reference electrode for 3-electrode measurements (no „3e“ option).

The default sample diameter is 6 mm (no 3e option), 10 mm, or 12 mm. Other diameters might be available on demand. The maximal applicable force might depend on the piston diameter.



## Selected technical specifications

Temperature range (operation)	T <sub>operation</sub> = -40 °C ... +150 °C (PEEK sleeve) / +200 °C (PEI sleeve) / +250 °C (Al <sub>2</sub> O <sub>3</sub> sleeve)
Plunger diameter	6 mm, 10 mm or 12 mm
Piston material	Hard metal (90% Tungsten carbide, 10% Cobalt)
Max. applicable force	F <sub>max</sub> = 75 kN (10 mm, 12 mm piston) / 50 kN (6 mm piston)
Total weight	approx. 1.3 kg
Rated dimensions	6 cm x 6 cm x 13.4 cm (L x W x H)

# Compre-Cell Pouch

## Fixture for testing pouch cells at various pressures and temperatures

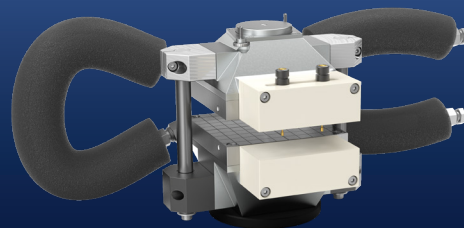
Benefit from this innovative fixture for testing batteries in a pouch cell format under various conditions. The fixture shows outstanding features:

- Broad accessible pressure and temperature range
- Measurement of thickness-changes in combination with Distance-Addon
- Can be combined with 2D-pressure-mapping sensors



*„Finally, a tool for testing pouch cells that enables reproducible results.“*

**Battery Expert**



## Typical applications

The CompreCell Pouch combined with the CompreFrame or CompreDrive is the ideal solution for controlling the stack pressure and temperature of batteries in a pouch cell format. That opens the door to intriguing applications:

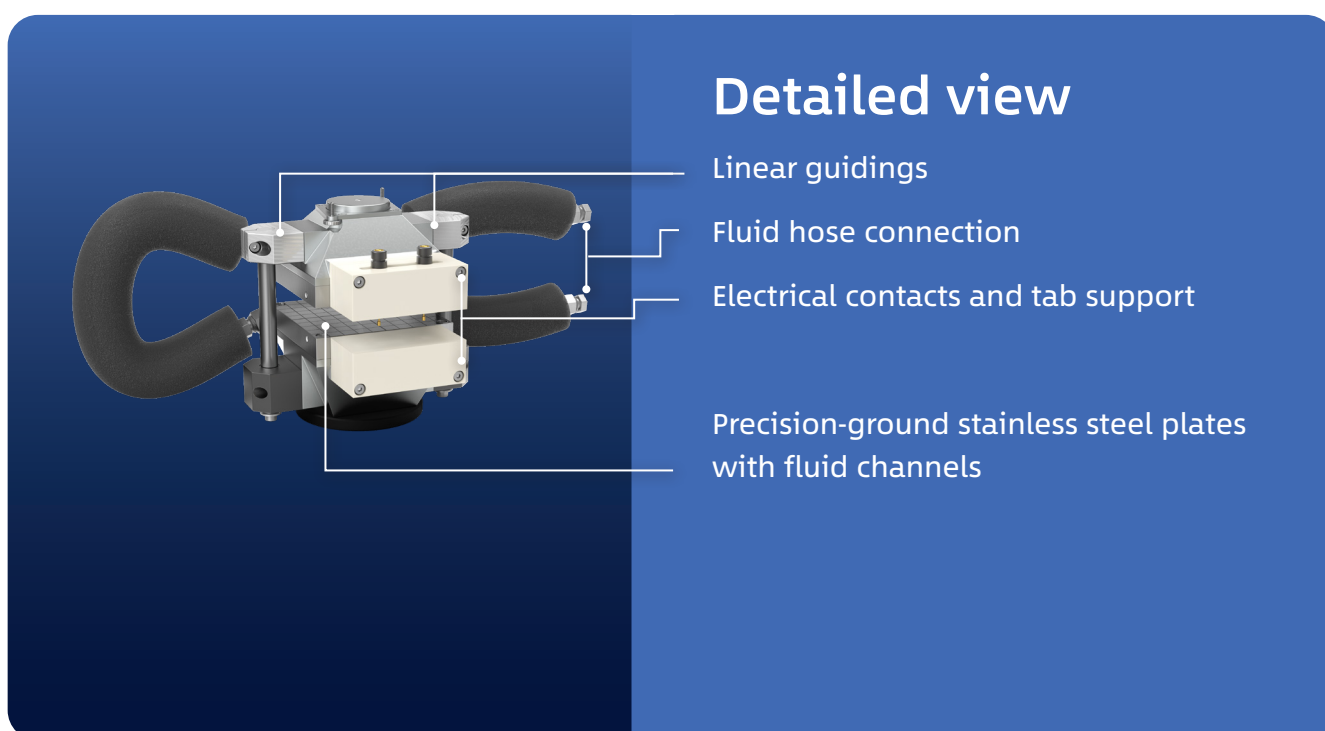
- Cycling of pouch cells under active stack pressure and temperature control
- In combination with Distance-Addon: Monitoring of thickness changes of pouch cell format batteries during cycling
- Switching between measuring at constant volume and constant pressure

## Detailed description

The CompreCell Pouch is a fixture developed for use with the CompreDrive and the CompreFrame setup. It is designed to enable the electrochemical characterization of pouch cell format batteries using common electrochemical methods while precisely regulating the applied force (stack pressure) and temperature (HC-Addon and an external circulating thermostat needed).

Depending on the chosen pressure frame, the operator can switch seamlessly between pouch cell measurements at constant pressure and constant volume. In combination with the Distance-Addon, a true-constant volume measurement is possible since the input from the confocal sensor can be used as control parameter for ensuring a constant distance between the plates (only with CompreDrive). The CompreCell Pouch can be operated in combination with every

available potentiostat/galvanostat model. The cell employs a solid stainless-steel body with a square sample stage (e.g. 10 cm x 10 cm for 10S variant). The rated maximum applicable force is 75 kN. The rated maximum sample height is 20 mm (10 mm when being combined with the CompreFrame). Furthermore, with this setup temperatures between 0 °C and +100 °C can be realized (external circulating thermostat needed). A drip pan ensures to catch any condensed water.



## Selected technical specifications

<b>Max. sample size</b>	10 cm x 10 cm x 2 cm („10S“ version, CompreDrive) 10 cm x 10 cm x 1 cm („10S“ version, CompreFrame)
<b>Max. application force</b>	75 kN
<b>Max. temperature range</b>	0 °C ... +100 °C* *Requires external circulating thermostat
<b>Total weight</b>	approx. 8 kg
<b>Options</b>	<ul style="list-style-type: none"> <li>• Can be combined with Distance-Addon</li> <li>• Can be combined with 2D pressure mapping sensors</li> </ul>



# HC-Addon

## Accessory for heating and cooling CompreCells

Benefit from this precise and fast way of heating and cooling your CompreCell (requires a circulating thermostat that is not included in the scope of delivery). This accessory shows outstanding features:

- Allows for heating and cooling the CompreCell, CompreCell DP or CompreCell Pouch, enabling a broad temperature range
- Precise temperature control
- Implemented in CompreDriveControl for automated procedures



*„A must-have for all people working on solid-state batteries “*

CTO



## Typical applications

The default application is to heat the CompreCell, CompreCell DP or CompreCell Pouch to allow for temperature-dependent measurements:

- Determination of the temperature-dependent conductivity of solid electrolytes
- Cycling solid-state batteries at different temperatures
- Stripping-plating experiments at different temperatures
- Cycling of lithium-ion, sodium-ion, or solid-state batteries in pouch cell format at different temperatures

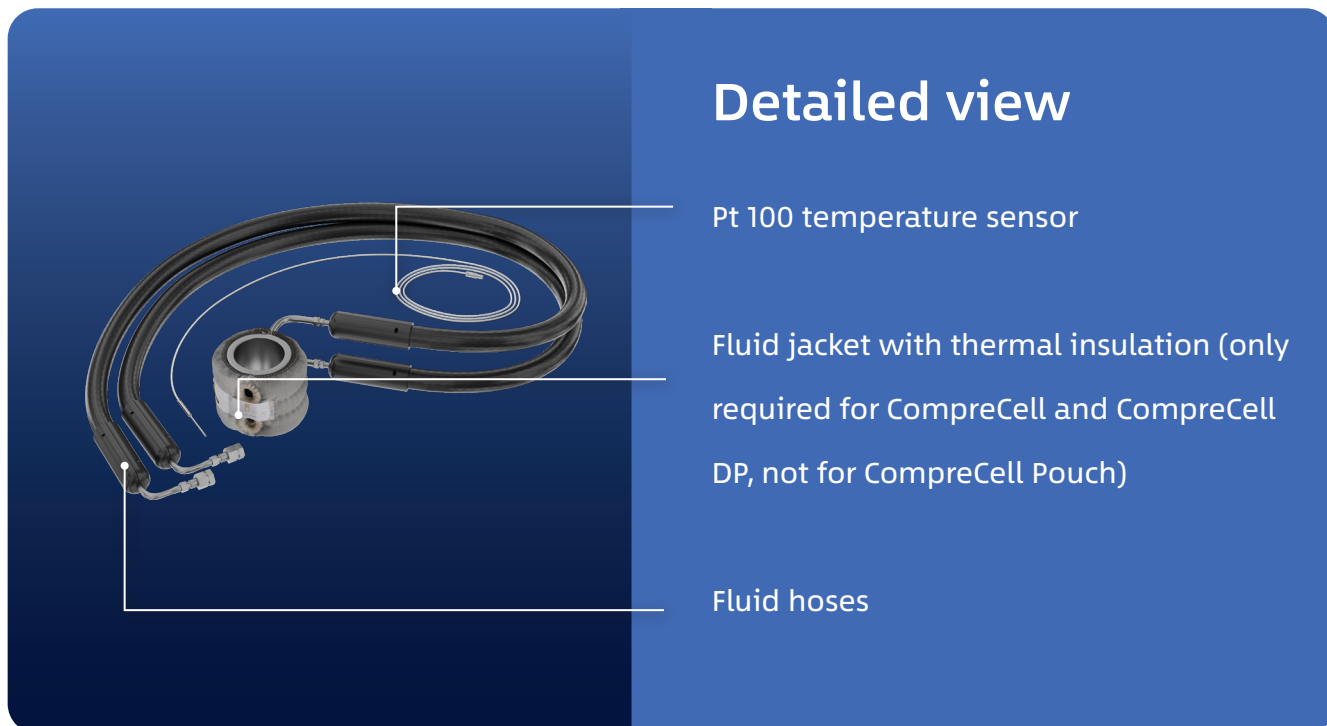
## Detailed description

The HC-Addon is compatible with the CompreDrive and CompreFrame setup. It is designed to be used only in combination with the corresponding measuring cells (CompreCell and CompreCell DP) and cell fixtures (CompreCell Pouch).

The HC-Addon provides a fluid jacket which perfectly fits to the CompreCell measuring cells. The fluid conditioning is realized by an external circulating thermostat. By default, the HC-Addon DOES NOT include any

external circulating thermostat, but rhd instruments offers suitable, pre-configured devices. The HC-Addon is designed to fit any available thermostat to provide the user with a maximum of flexibility. The only limitation is that not all external circulating thermostats can be automatically controlled. So please contact us to get recommendations for suitable models and brands to

benefit from the highest level of automation. The accessible sample temperature range within the overall limit is given by the used thermostat, the allowed temperature range for the selected test cell, or the specific configuration of the CompreDrive. The heater is equipped with a removable thermal insulation to lower its outer temperature.



## Selected technical specifications

<b>Temperature range</b>	$T_{\text{operation}} = -40\text{ °C} \dots +250\text{ °C}$
<b>Connection thread fluid hoses</b>	M16x1
<b>Recommended circulating thermostat</b>	<p>Unistat 405 with Pilot ONE controller from Peter Huber Kältemaschinenbau SE with SilOil M80.100/250.03 as heating fluid.</p> <p>Temperature with Unistat 405:</p> <ul style="list-style-type: none"> <li>-30 °C ... +230 °C (CompreCell and CompreCell DP)</li> <li>0 °C ... +100 °C (CompreCell Pouch)</li> </ul> <p>Temperature accuracy = +/- 0.1 °C</p>

# H-Addon

## Accessory for heating CompreCells

Benefit from this precise and fast way of heating your CompreCell. This accessory shows outstanding features:

- Heat your CompreCell to temperatures ranging from RT to +250 °C
- Not compatible with CompreCell Pouch
- Precise temperature control:  $\pm 0.1$  °C
- Implemented in CompreDriveControl for automated procedures



*„Very efficient  
and fast solution to heat  
my samples. “*

**Senior Engineer**



## Typical applications

This very useful addon can be combined with the CompreDrive and CompreFrame and can be used to heat up the test cells CompreCell and CompreCell DP enabling electrochemical measurements at different temperatures.

- Determination of the temperature-dependent conductivity of solid electrolytes
- Cycling solid-state batteries at different temperatures
- Stripping-plating experiments at different temperatures

## Detailed description

The H-Addon can be used with the CompreDrive and the CompreFrame setup and is compatible with the CompreCell and CompreCell DP. It is designed to enable the electrochemical testing of solid electrolytes or solid-state batteries while precisely regulating the applied temperature of the sample between room temperature and +250 °C (max. applicable temperature depends on selected sleeve material).

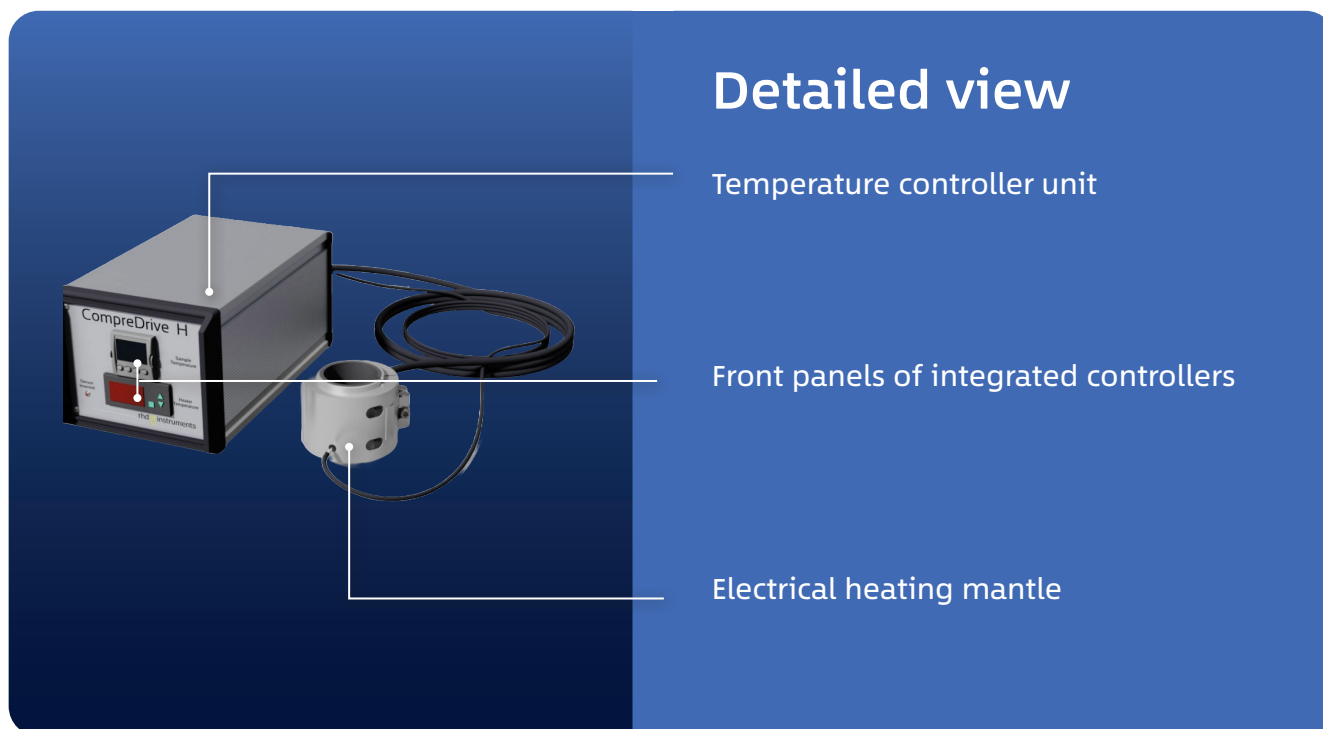


The heater can be adjusted to ensure best thermal contact to the cell.

Moreover, the heater has a built-in insulation to lower its outer temperature. It is also connected to protective earth to provide shielding of the cell from electromagnetic noise. In addition, the ground connector of

the measuring device can be connected to the heater as well.

The H-Addon is equipped with a serial connection interface which enables the communication between any PC and the temperature controller. Using this interface, automated temperature-dependent measuring procedures can be established.



## Selected technical specifications

<b>Temperature range</b>	$T_{\text{operation}} = \text{RT} \dots +250\text{ }^{\circ}\text{C}$
<b>Mains voltage</b>	$U_{\text{AC}} (\text{rms}) = 115 \dots 230\text{ V}, 50\text{-}60\text{ Hz}$
<b>Rated dimensions</b>	33 cm x 19 cm x 16 cm (L x W x H)
<b>Total weight</b>	5.6 kg
<b>Suitable pressure frames</b>	CompreDrive and CompreFrame
<b>Compatible test cells</b>	CompreCell and CompreCell DP

# Distance-Addon

## Accessory for dilatation measurement of pouch cells

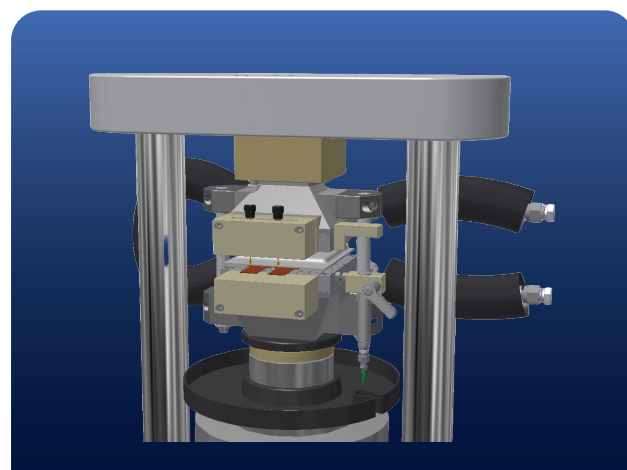
Benefit from this add-on for the CompreCell Pouch in combination with either the CompreDrive or the CompreFrame, allowing for precise dilatation measurements. This accessory shows outstanding features:

- Resolution 40 nm, accuracy 1  $\mu\text{m}$
- Fast and comfortable assembly and handling
- Implemented in CompreDriveControl to have an optimal level of synchronisation with electrochemistry data



*„Monitoring thickness changes of our pouch cells using this tool is essential for us.“*

**Lab Manager**



## Typical applications

By means of the Distance-Addon, you can follow pressure-, temperature-, and/or SoC-induced thickness changes of pouch cell batteries.

- Monitoring of “breathing” of pouch cells during cycling
- Investigation of thickness creeping over time
- Studying pressure- or temperature induced thickness changes
- „True constant volume“ mode for CompreDrive, with active thickness regulation

## Detailed description

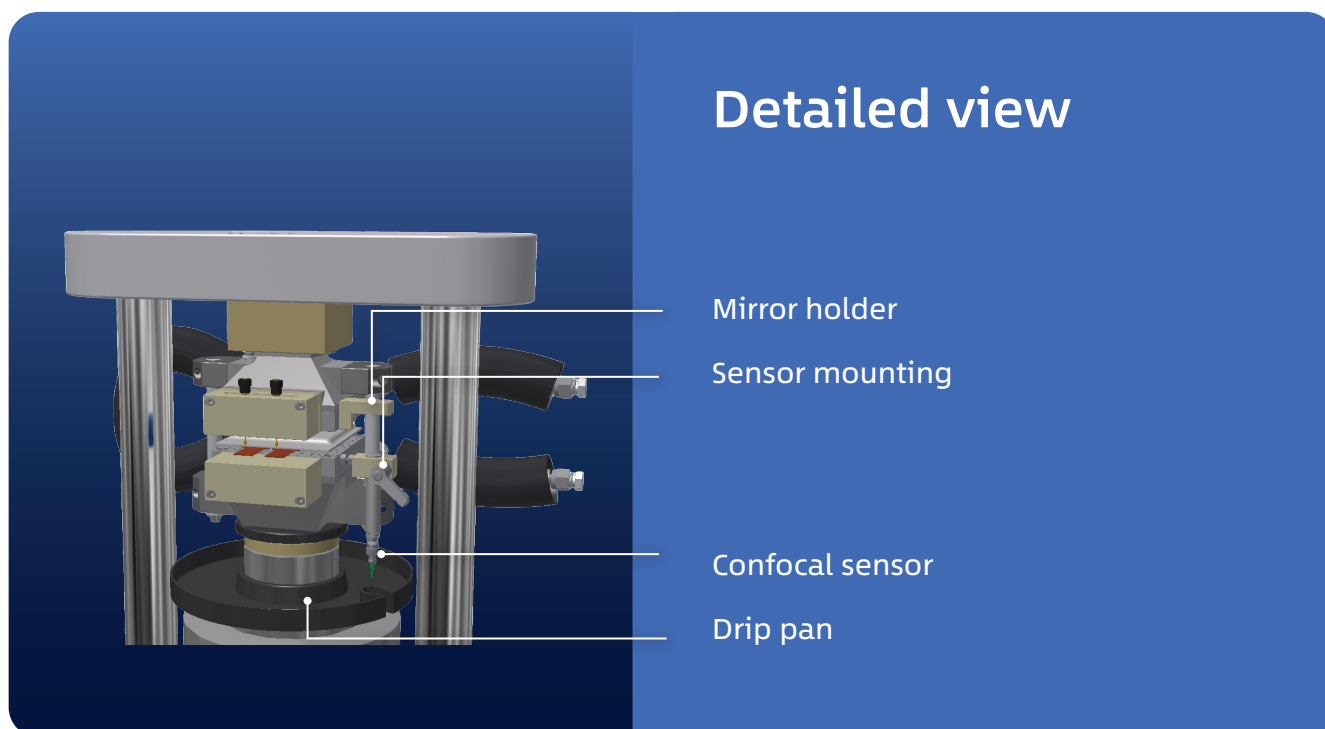
The Distance-Addon is used to allow for the most precise monitoring of thickness changes of pouch cells.

It is attached directly to the metal plates of the CompreCell Pouch cell holders. The cell holders offer female threads at the plates, where the sensor mount and mirror mount are attached. By doing so, only minimal influences of the frame are included in the signal and only the displacement of the pouch cell itself is measured. To reach

highest precision, an optical confocal sensor is used. It offers a resolution of 40 nm and a full-range linearity of 1  $\mu\text{m}$ . Hence, also thickness changes of single-layer pouch cells can be monitored during cycling.

The system includes the optical sensor and the controller with ethernet connection.


It is fully integrated into the CompreDrive hardware and software. We provide a special software that allows for the optimal alignment of the sensor and the transfer of raw and tare data (thickness of the pouch cell can be specified). The total measuring range of 2 mm of the sensor also allows the investigation of multilayer pouch cells.



## Selected technical specifications

<b>Sensor specification</b>	Confocal sensor (14 mm minimum distance, 2 mm measuring range, 40 nm resolution, 1 $\mu\text{m}$ linearity full range)
<b>Power supply</b>	Power supply from CompreDrive main unit (if used stand-alone or with CompreFrame, a 24 V DC power supply will be provided).
<b>Connections and Interfaces</b>	Confocal controller with ethernet data connection, pre-configured to be used with CompreDriveControl





# Test cells for electrochemical test methods

e.g. for testing battery materials



## Modular concept

Switch within seconds between different test cells being optimized for different applications and sample types.



## Automation

Automate the temperature control step as part of your measurement routine by integrating the communication with the Microcell HC setup into your procedures.



## Quality

All parts are made of premium materials and are the result of the highest level of craftsmanship and engineering - a very good basis for generating high-quality data in electrochemical testing.



## Low required sample amount

Only a small sample amount is needed opening new horizons when studying new, innovative materials that are synthesized in your laboratory - e.g. for lithium batteries.

## Test cells

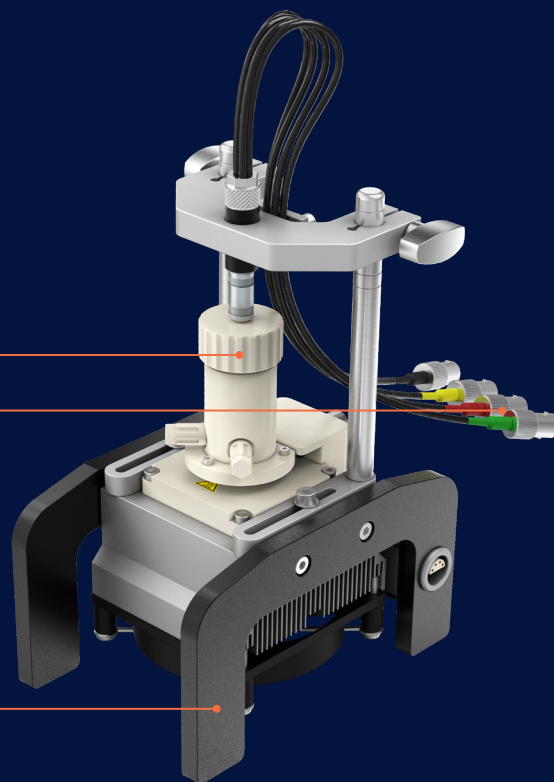
Air-tight test cells designed for the electro-chemical characterization of liquid and solid samples which require only a small sample amount.

## Level of integration

The test cells can be used with all different models and brands of potentiostats, with the option to have automated temperature control in almost all cases.

## Cell fixtures

Modular cell fixtures to contact different test cells, with the option to adjust the temperature.



## Cell Fixtures .....32



## Test Cells (Microcell) ..... 36



## Test Cells (Others) ..... 50



## Accessories.....52



# Microcell HC

## Test cell fixture for heating and cooling „TSC“ cells

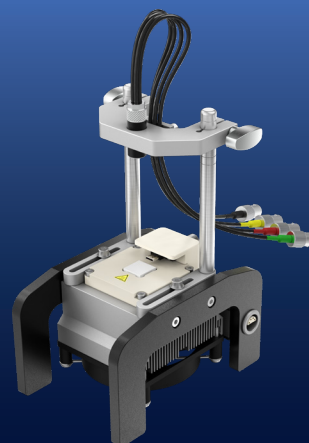
Benefit from this test cell fixture to reach improved reproducibility due to a high level of temperature accuracy and a high level of automation.

- Modular concept: quick exchange between different test cells
- Precise and fast heating and cooling based on Peltier-element technique
- No temperature overshooting
- Automated temperature control as part of electrochemical measuring routines



*„That temperature control option saved me so much time!“*

**PhD Student**



## Typical applications

The Microcell HC Package has been designed for the test cells of the “TSC” product line and opens up a broad range of different applications, like:

- Determination of the temperature-dependent conductivity of liquid, gel-like, polymeric, and solid electrolytes
- Charging/discharging of batteries and supercaps at different temperatures
- Performing temperature-dependent cyclic voltammetry measurements

## Detailed description

The Microcell HC Basic Package consists of a temperature controller unit and a cell fixture plus cables and other required or helpful accessories. The cell fixture is compatible with all test cells with prefix “TSC” and can be used to electrically contact the test cell’s base unit and cap and to set and actively control the test cell’s temperature.

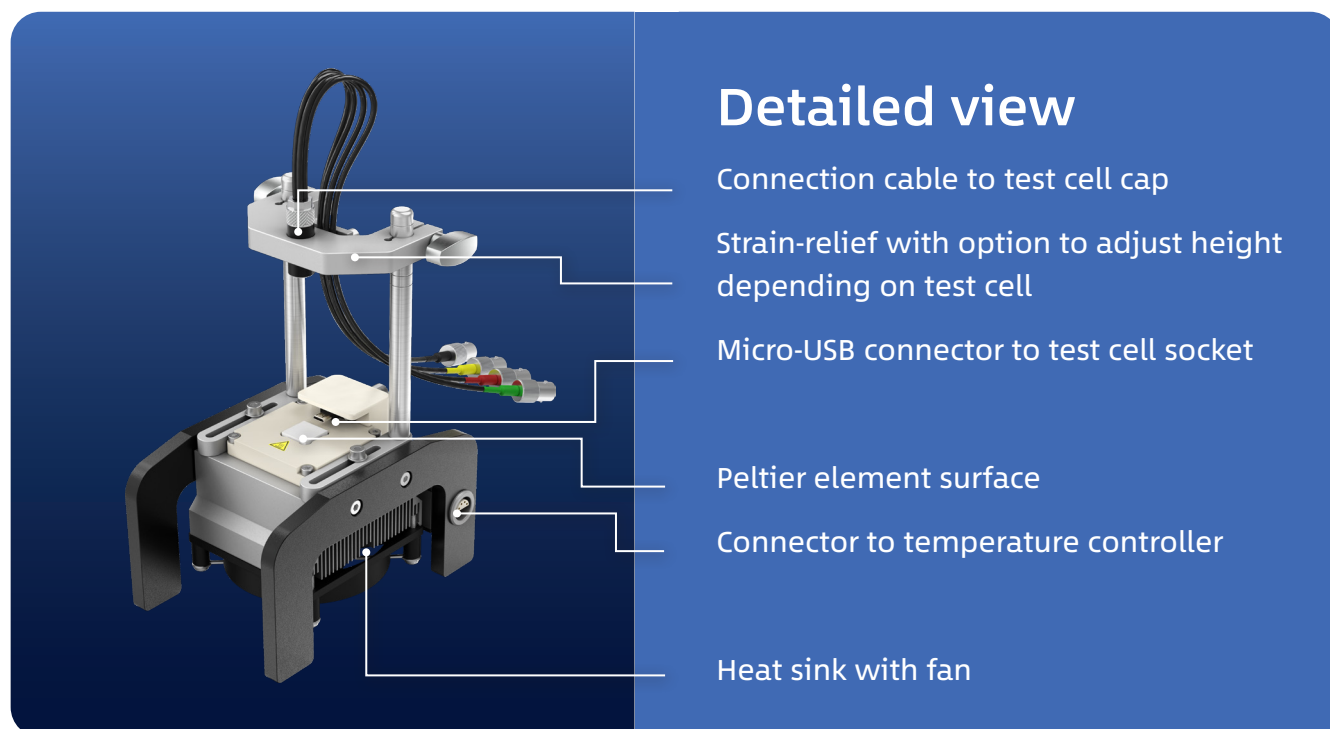
The cell fixture contains a Peltier element that is used to heat or cool the test cell being placed on top of it. The communica-



tion with the temperature controller unit can be embedded in routine electrochemical procedures in case of most potentiostat brands and models, either using serial connectivity(RS232) or analogue in/out signals. By embedding the temperature adjustment and reading step into electrochemical procedures, a high level of automation can be

achieved.

The test cell fixture can be used outside or inside of a glovebox. When being used inside of a glovebox, a cable-feedthrough is required (available on demand) and the temperature controller is placed outside.



## Selected technical specifications

<b>Compatible test cells</b>	<ul style="list-style-type: none"> <li>• TSC 70/1600 Closed (GC)</li> <li>• TSC Battery</li> <li>• TSC Surface</li> <li>• TSC Spectro</li> <li>• TSC Raman</li> </ul>
<b>Max. temperature range</b>	-40 °C* ... +100 °C *accessible in combination with rhd Cooling Box
<b>Communication protocol</b>	Modbus via RS232 and analogue I/O option
<b>Mains voltage</b>	$U_{AC}$ , rms = 100 - 230 V, 50/60 Hz
<b>Optional accessories</b>	rhd Cooling Box, MultiSourceBox

# Microcell Passive

## A robust test cell fixture for „TSC“ cells

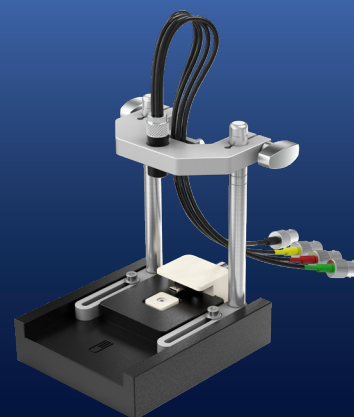
Benefit from this easy-to-use, robust test cell fixture.

- Modular concept: quick exchange between different test cells
- Can be placed in a climate chamber or oven to adjust the temperature
- High-quality design to keep the test cell in place and to ensure a hassle-free establishment of connections to the potentiostat



*„I like that very robust test cell fixture.“*

**Master Student**



## Typical applications

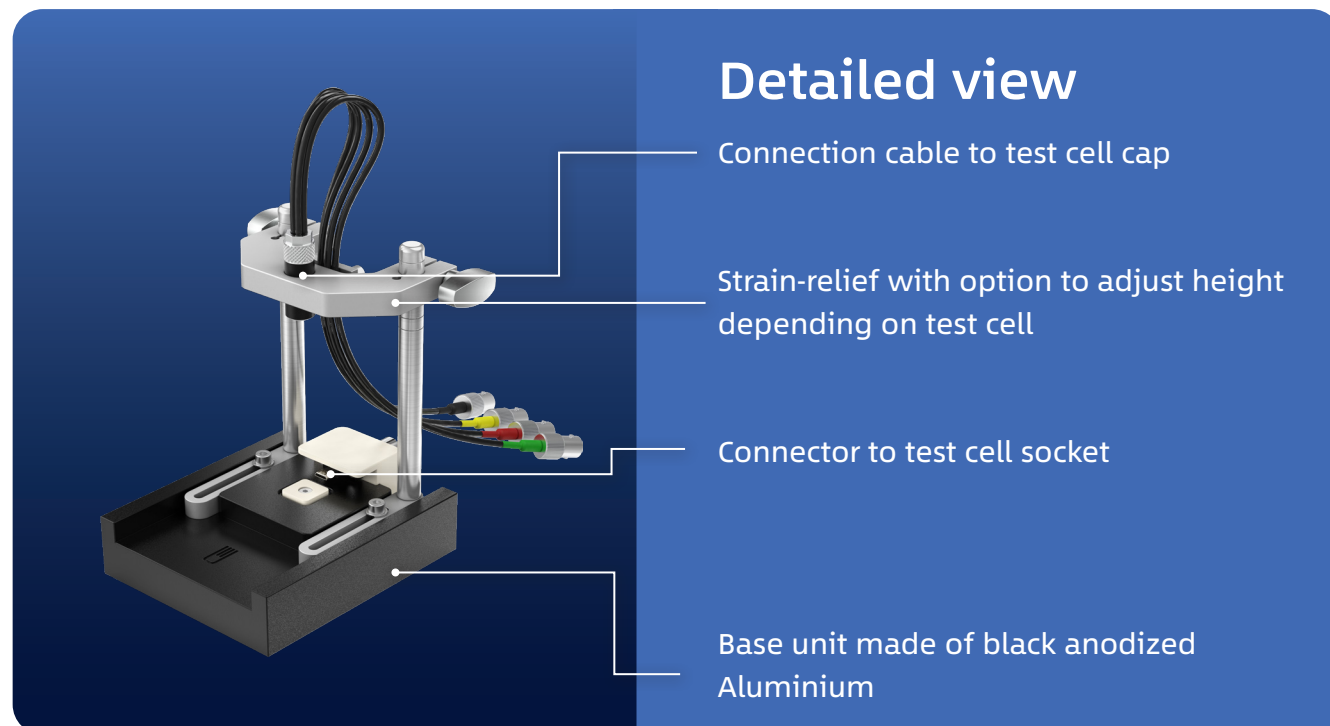
The Microcell Passive cell fixture has been designed for the test cells of the „TSC“ product line and opens a broad range of different applications, like:

- Determination of the conductivity of liquid, gel-like, polymeric and solid electrolytes at room temperature or at different temperatures when being used in a climate chamber or oven
- Charging/discharging of batteries and supercaps
- Performing cyclic voltammetry measurements
- Performing spectro-electrochemistry measurements (UV/Vis in transmission, in-situ Raman)

## Detailed description

The Microcell Passive test cell fixture comes with useful accessories like a BNC-to-banana adapter box. The cell fixture is compatible with all test cells with prefix "TSC" and can be used to electrically contact the test cell's base unit and cap.

For performing temperature-dependent measurements, this robust and easy-to-handle fixture can be used inside of climate chambers.



## Selected technical specifications

<b>Compatible test cells</b>	<ul style="list-style-type: none"> <li>• TSC 70/1600 Closed (GC)</li> <li>• TSC Battery</li> <li>• TSC Surface</li> <li>• TSC Spectro</li> <li>• TSC Raman</li> </ul>
<b>Temperature range during operation, e.g. inside of oven</b>	0 °C ... +75 °C
<b>Size and weight</b>	13 cm x 9.5 cm x 20 cm (L x W x H), 1 kg
<b>Optional accessories</b>	Connector modification to read out sample temperature

# TSC 70 Closed

## Small volume test cell for liquid electrolytes with low vapor pressure

Benefit from this test cell for performing electrochemical measurements to study liquid samples with low vapor pressure, e.g. ionic liquids.

- Only small sample amounts required
- Robust, user-friendly design
- Air-tight: moisture- and air-sensitive samples can be studied
- Cap with 4 Pt wire electrodes, insulated against each other by glass
- Pt crucible as container and electrode



*„What a nice  
solution for testing  
ionic liquids“*

**PostDoc**



## Typical applications

This test cell can be used for experiments with both a 2-electrode and a 3-electrode configuration. Typical applications are:

- Determination of the conductivity of liquid electrolytes
- Investigation of the electrochemical stability window of liquid electrolytes
- Cyclic voltammetry studies of redox-active samples

## Detailed description

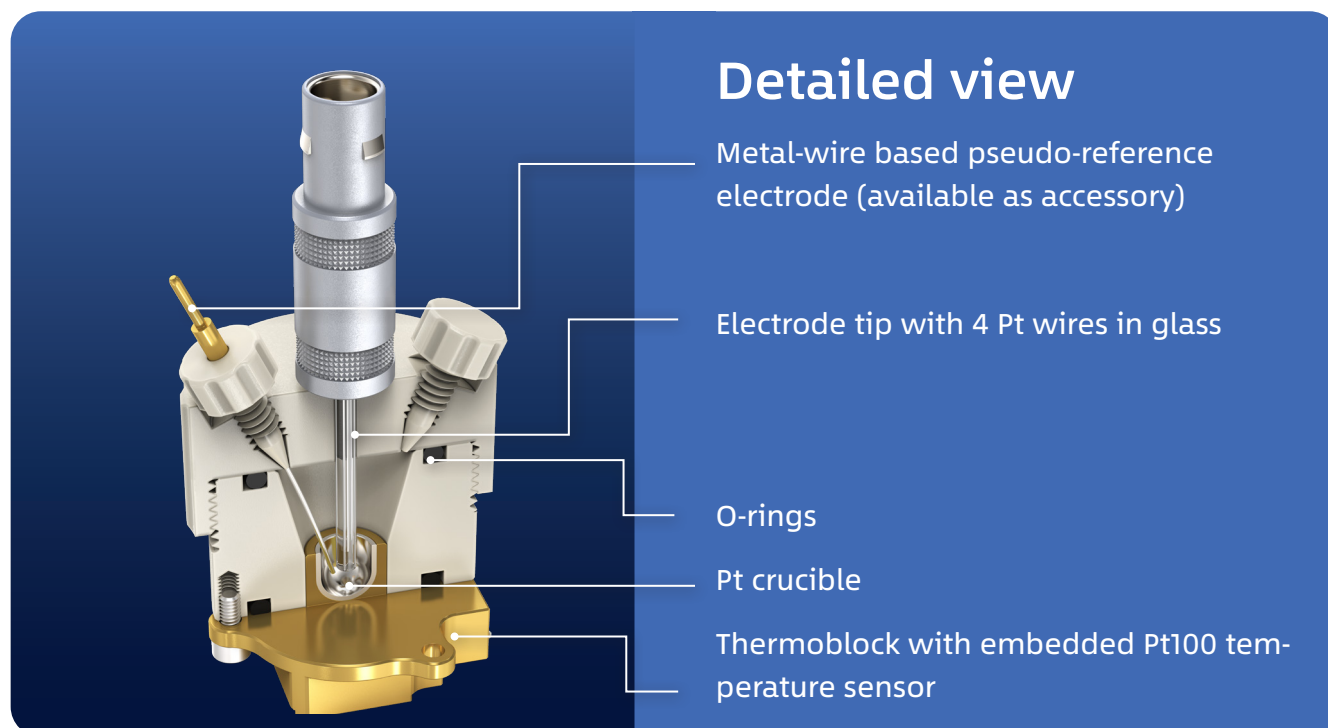
The test cell TSC 70 closed consists of several high-quality building blocks: The gold-plated base unit (= "thermo block") comes with an integrated Pt100 temperature sensor that monitors the temperature very close to the sample, as well as a fixed platinum crucible that serves as sample container and counter electrode. To seal the test cell, a housing made of polyether ether ketone (PEEK) with two o-ring grooves is used which connects the base unit and the cap.

In case of the test cell TSC 70 closed, the PEEK cap has an integrated



electrode plug made of a soda-lime glass sleeve bearing 4 separately connectable platinum electrodes, each with a polished front-end. Furthermore, the cap has two inlets that are sealed by plugs by default, but can be used for inserting capillaries or (pseudo-) reference electrodes made of metal wires.

Attention: Due to the very low sample volume and the inner dead volume, this test cell is recommended for studying samples with a quite low vapour pressure, e.g. like ionic liquids. For samples with higher vapour pressure, we recommend to use the test cell TSC 1600 closed or TSC 1600 closed GC instead.



## Selected technical specifications

<b>Suitable samples</b>	Liquid electrolytes with relatively low vapour pressure, gels with low viscosity
<b>Max. temperature range</b>	-40 °C ... +100 °C
<b>Materials in sample contact</b>	PEEK, Pt, lime soda glass, EPDM, gold-plated copper with nickel interlayer
<b>Sample volume</b>	max. 100 µl, min 70 µl
<b>Diameter Pt electrodes in glass</b>	0.25 mm each
<b>Option</b>	Cap with exchangeable electrode tip

# TSC 1600 Closed

## Small volume test cell for liquid electrolytes

Benefit from this test cell for performing electrochemical measurements to study liquid samples e.g. electrolyte solutions in lithium-ion battery research

- Only small sample amounts required
- Robust, user-friendly design
- Air-tight: moisture- and air-sensitive samples can be studied
- Cap with 4 Pt wire electrodes, insulated against each other by glass
- Pt crucible as container and electrode



*„I could measure  
pretty nice CVs of  
my OLED dyes.“*

**Junior scientist**



## Typical applications

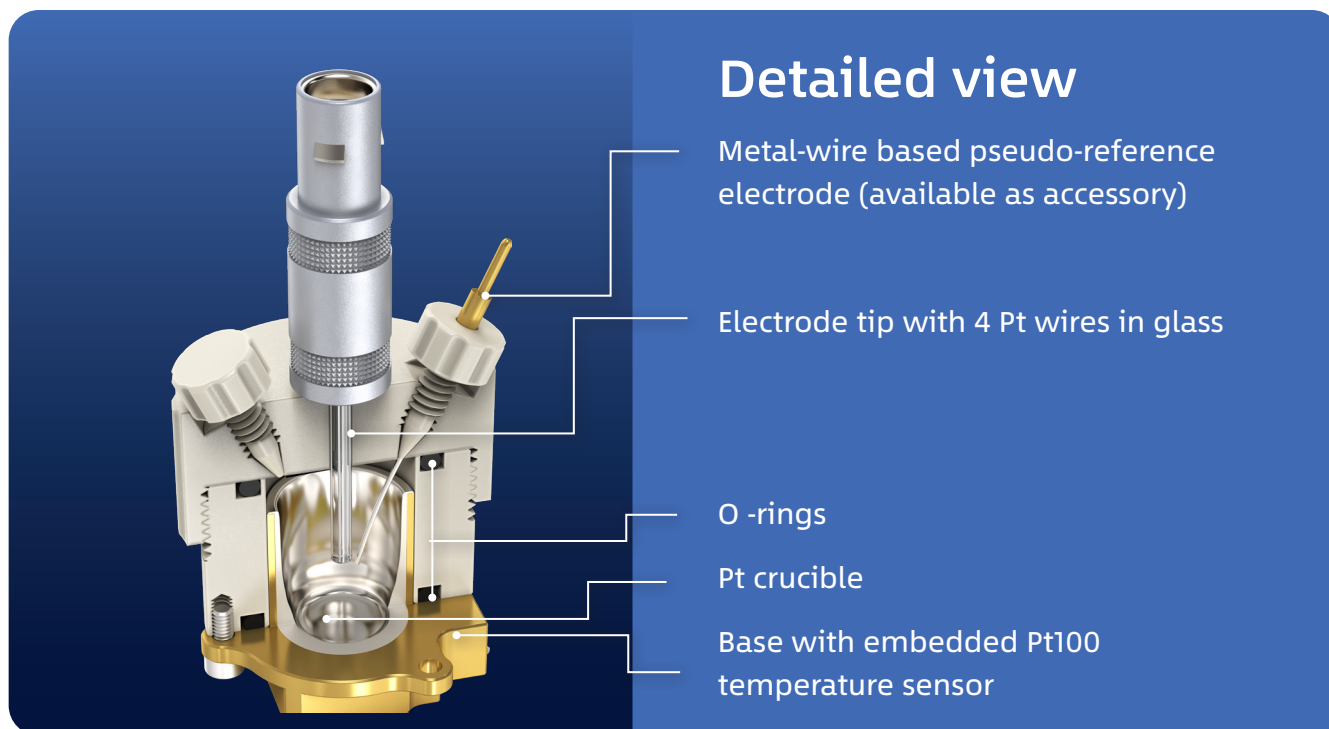
This test cell can be used for experiments with both a 2-electrode and a 3-electrode configuration. Typical applications are:

- Determination of the conductivity of liquid electrolytes
- Investigation of the electrochemical stability window of liquid electrolytes
- Cyclic voltammetry studies of redox-active samples

## Detailed description

The test cell TSC 1600 closed consists of several high-quality building blocks: The gold-plated base unit (= "thermo block") comes with an integrated Pt100 temperature sensor that monitors the temperature very close to the sample, as well as a fixed platinum crucible that serves as sample container and counter electrode. To seal the test cell, a housing made of polyether ether ketone (PEEK) with two o-ring grooves is used which connects the base unit and the cap.

The PEEK cap has an integrated electrode plug made of a soda-lime glass sleeve bearing 4 separately connectable platinum electrodes, each with a polished front-end. Furthermore, the cap has two inlets that are sealed by plugs by default, but can be used for inserting capillaries or (pseudo-) reference electrodes.



## Selected technical specifications

<b>Suitable samples</b>	Liquid electrolytes, gels with low viscosity
<b>Max. temperature range</b>	-40 °C ... +100 °C
<b>Materials in sample contact</b>	PEEK, Pt, lime soda glass, EPDM
<b>Sample volume</b>	min 0.9 ml, max 1.0 ml
<b>Diameter Pt electrodes in glass</b>	0.25 mm each
<b>Option</b>	Cap with exchangeable electrode tip

# TSC 1600 Closed GC

## Small volume test cell for liquid electrolytes – HF-compatible

Benefit from this test cell for performing electrochemical measurements to study liquid samples, e.g. lithium-ion battery electrolytes.

- Only small sample amounts required
- Robust, user-friendly design
- Air-tight: moisture- and air-sensitive samples can be studied
- Cap with exchangeable electrode tip (default material: glassy carbon)
- Pt crucible as container and electrode



*„That test cell helped  
me a lot to obtain reliable  
conductivity data .“*

**Senior Scientist**



## Typical applications

This test cell can be used for experiments with both a 2-electrode and a 3-electrode configuration. Typical applications are:

- Determination of the conductivity of liquid electrolytes
- Investigation of the electrochemical stability window of liquid electrolytes
- Cyclic voltammetry studies of redox-active samples

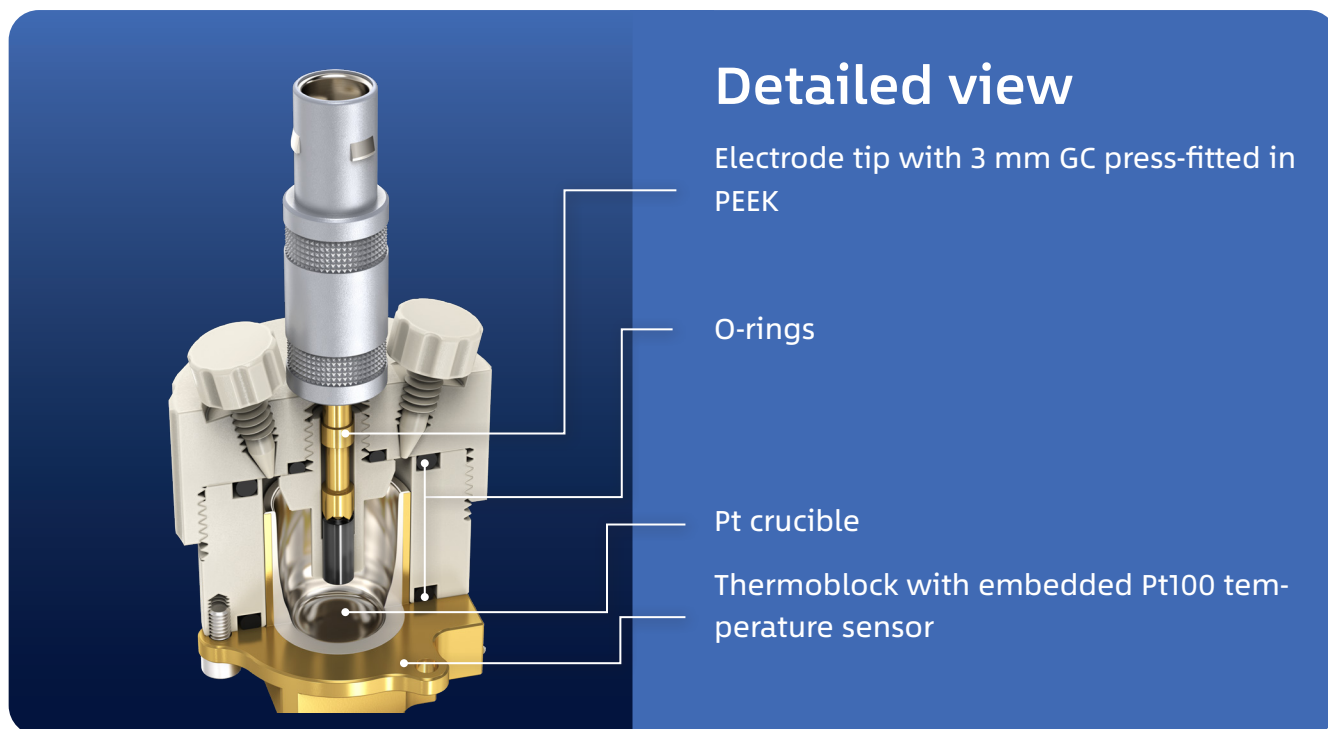
## Detailed description

The test cell TSC 1600 Closed GC consists of several high-quality building blocks: The gold-plated base unit (= "thermo block") comes with an integrated Pt100 temperature sensor that monitors the temperature very close to the sample, as well as a fixed platinum crucible that serves as sample container and counter electrode. To seal the test cell, a housing made of polyether ether ketone (PEEK) with two o-ring grooves is used which connects the base unit and the cap.



In case of the TSC 1600 Closed GC, the PEEK cap has an exchangeable electrode tip made of a glassy carbon rod press-fitted in a PEEK sleeve. The mirror-like polished surface of the glassy carbon rod is exposed to the sample electrolyte. Other electrode tip materials are available on demand.

Furthermore, the cap has two inlets that are sealed by plugs by default, but can also be used for inserting capillaries or (pseudo-) reference electrodes made of metal wires.



## Selected technical specifications

<b>Suitable samples</b>	Liquid electrolytes, gels with low viscosity
<b>Max. temperature range</b>	-40 °C ... +100 °C
<b>Materials in sample contact</b>	PEEK, Pt, glassy carbon, EPDM, FFKM, gold
<b>Sample volume</b>	min. 0.9 ml, max 1.0 ml
<b>GC electrode diameter</b>	3.0 mm
<b>Option</b>	Electrode tips with other electrode materials like Pt, Au, other metals

# TSC Battery

## Test cell for studying battery and supercap materials

Benefit from this test cell with plate-plate geometry for battery and supercap material testing as well as for separator and polymer electrolyte characterization.

- Only small sample amounts required
- Robust, user-friendly design
- Air-tight: moisture- and air-sensitive samples can be studied
- Flexible design with different variants



*„A perfect tool for testing separator foils.“*

**Quality Manager**



## Typical applications

This test cell can be used for building and cycling batteries and supercapacitors, and beyond it is a perfect solution for testing wetted separator materials, polymer electrolytes, or coated solid electrolyte pellets.

- Determination of a separator's MacMullin number and of an active material's tortuosity
- Determination of the conductivity of polymer electrolytes or coated ceramic electrolyte pellets
- Supercap and battery cycling

## Detailed description

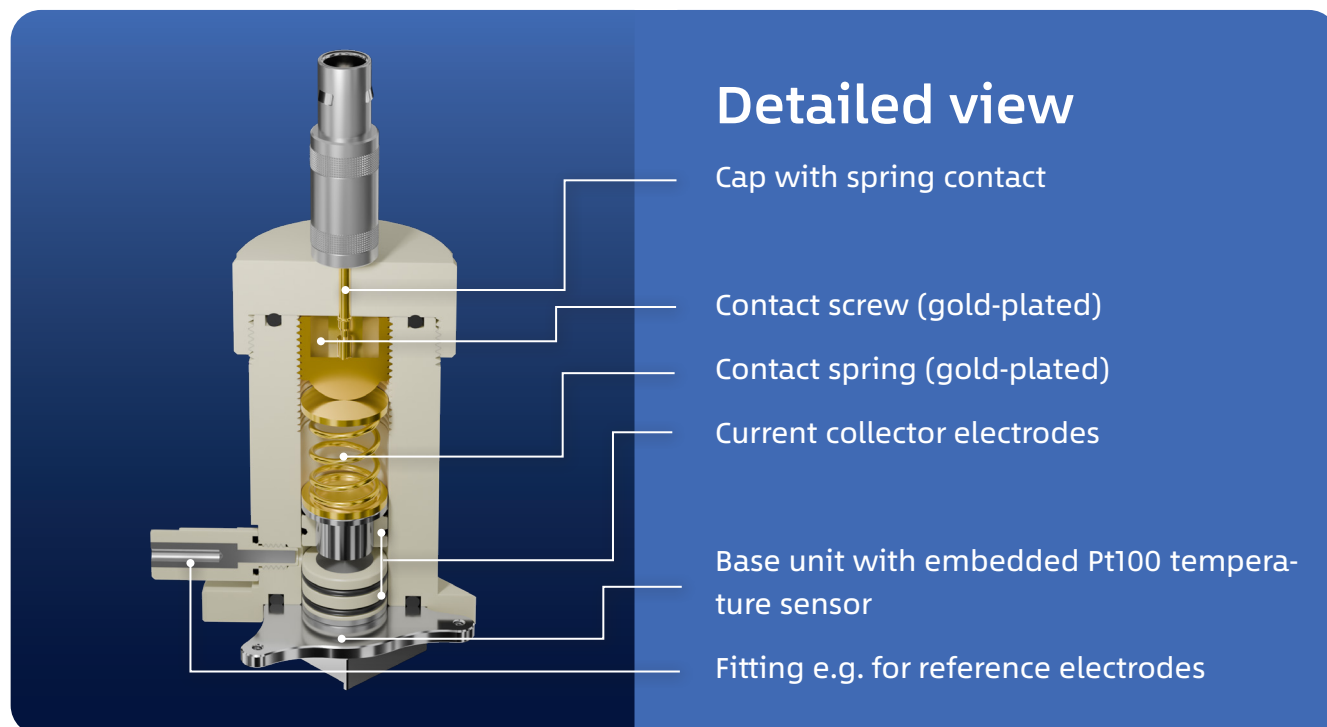
The test cell TSC Battery consists of several high-quality building blocks: The nickel-plated base unit (= "thermo block") comes with an integrated Pt100 temperature sensor to monitor the temperature very close to the sample. It is followed by a pair of current collector electrodes made of stainless steel 1.4404 press-fitted in PEEK-sleeves (PEEK = polyether ether ketone) with outer o-rings. There are two different types of current collector electrodes available: flat current collector electrodes with or without lateral PEEK insulation, and current collector electrodes with a punching edge made of PEEK

to punch out metallic lithium or sodium from a foil.

To seal the test cell, a housing made of PEEK with two o-ring grooves is used which connects the base unit and the cap. In the housing, there are two lateral ports for fittings which can be used to insert capillaries or

metal wires serving as (pseudo-) reference electrode.

The sample stack pressure can be adjusted with a gold-plated spring which is contacted by a spring contact in the cap via a gold-plated compression screw.



## Selected technical specifications

<b>Suitable samples</b>	Polymeric foils, solid pellets, coated metal foils
<b>Max. temperature range</b>	-40 °C ... +100 °C
<b>Materials in sample contact</b>	PEEK, stainless steel 1.4404, EPDM
<b>Max. sample diameter</b>	12.0 mm
<b>Stack pressure range</b>	approx. 30 kPa - 1.1 MPa
<b>Option</b>	<ul style="list-style-type: none"> <li>• Electrode with punching edge</li> <li>• Housing without ports</li> <li>• Collector electrode without PEEK insulation</li> </ul>

# TSC Surface

## Test cell for studying electrolyte/electrode interfaces

Benefit from this versatile test cell for many different electrochemical applications.

- Only small sample amounts required
- Cap with exchangeable electrode tips allowing for many different electrode material options
- Air-tight: moisture- and air-sensitive samples can be studied
- Flexible, multi-purpose test cell based on a robust and user-friendly design



*„I was surprised to see how versatile that test cell is.“*

**PhD Student**



## Typical application

Due to its innovative design, this test cell can be used to address many different electrochemical applications.

- Electrochemical double layer studies by means of EIS (3-electrode configuration)
- Cyclic voltammetry studies of redox-active species
- Investigation of thin conductive films
- Van-der-Pauw measurements
- Corrosion measurements

## Detailed description

This test cell has been designed for studying solid-liquid interfaces. It is airtight and enables the investigation of air- and/or moisture-sensitive samples.

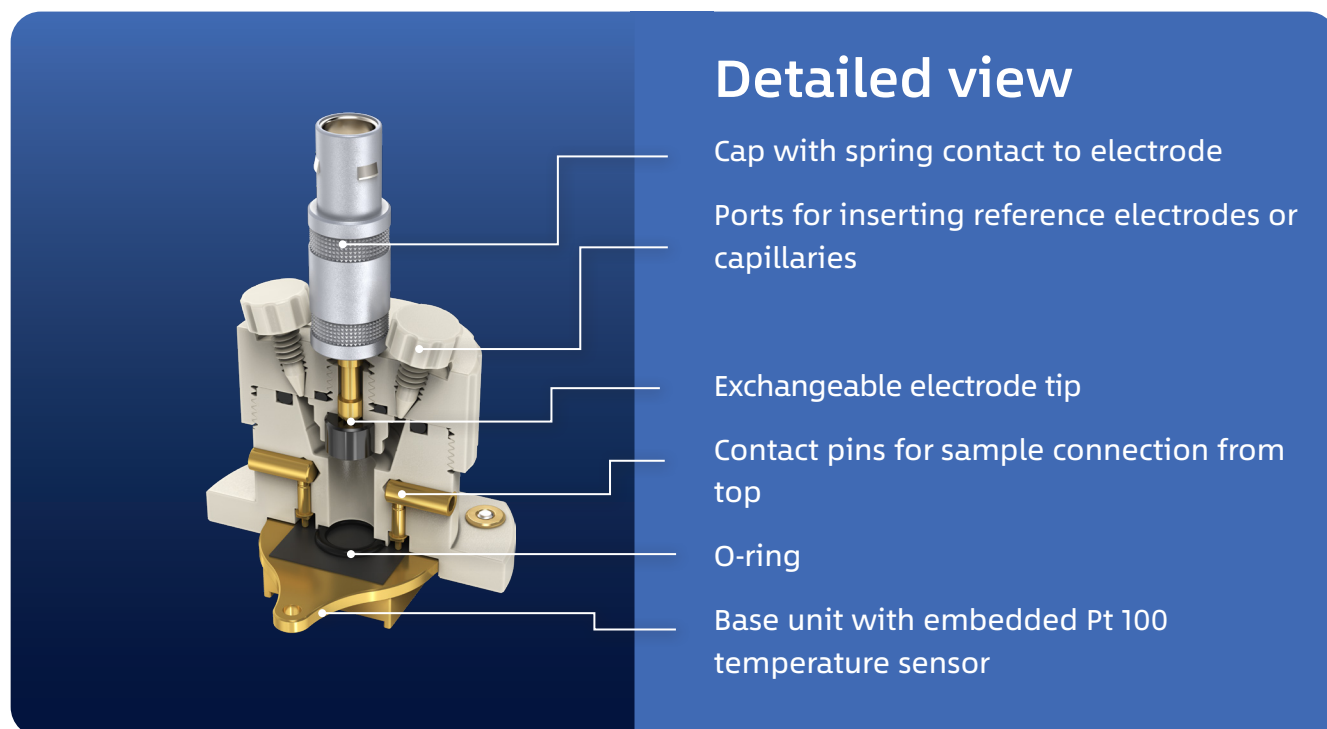
The electrochemically active area of the solid substrate is defined by a 6x1.5 mm o-ring clamped onto it from above. Four contact pins establish an electrical contact with the surface of the substrate. Thus, the substrate sheet can be contacted from below via the base unit or from above via the contact pins.



Two ports in the test cell housing and two ports in the test cell cap enable the usage of reference electrodes or allow for filling the test cell with electrolyte. An electrolyte amount of approx. 0.6 ml is required.

carbon electrode press-fitted in PEEK (diameter of electrochemically active surface area: 6 mm) is included. Exchangeable electrode tips with other materials can be offered on demand.

The cell is sealed by a cap with an exchangeable electrode tip. By default, a glassy



## Selected technical specifications

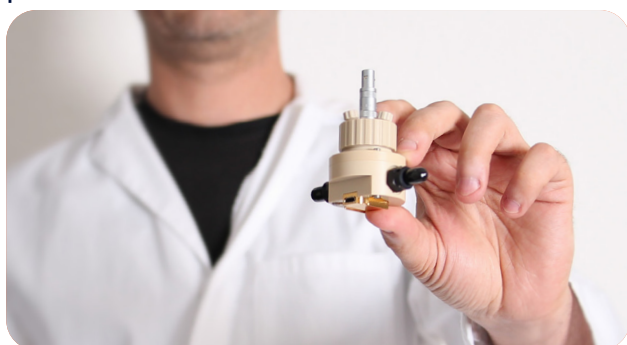
<b>Suitable samples</b>	Liquid electrolytes, flat coated sheets
<b>Max. temperature range</b>	-40 °C ... +100 °C
<b>Materials in contact with electrolyte</b>	PEEK, FFKM/EPDM, glassy carbon, sample material
<b>Possible sheet dimensions (min.)</b>	12.0 mm (round-shaped-sheets) 10.0 mm (rectangular sheets)
<b>Possible sheet dimensions (max.)</b>	20.0 mm (round-shaped sheets) 15.0 mm (rectangular sheets)
<b>Electrolyte volumen</b>	≈ 0,6 ml
<b>Options</b>	<ul style="list-style-type: none"> <li>• Other electrode materials</li> <li>• Re-fillable reference electrode</li> </ul>

# TSC Spectro

## Test cell for UV/Vis spectro-electrochemical studies in transmission

Benefit from this test cell to combine electrochemistry measurements with UV/Vis spectroscopy for studying the redox behavior of moisture- and air-sensitive samples.

- High-quality Pt mesh electrode design for performing UV/Vis spectro-electrochemical studies in transmission
- Flexible concept: Cap with exchangeable electrode tips allowing for many different counter electrode material options
- No more fragile glass vials – benefit from a robust, user-friendly design
- Air-tight: moisture- and air-sensitive samples can be studied



*„For the first time, I got the results I was expecting. Thank you!“*

**Assistant Professor**



## Typical applications

This test cell can be used for UV/Vis spectro-electrochemistry experiments in transmission to study the redox-behavior of redox-active species for a broad range of different applications.

- Investigation of UV/Vis active redox species by coupling UV/Vis spectroscopy (transmission mode) with cyclic voltammetry
- Determination of the permeability of a membrane for UV/Vis active molecules
- Determining of the lifespan of short-living intermediary species

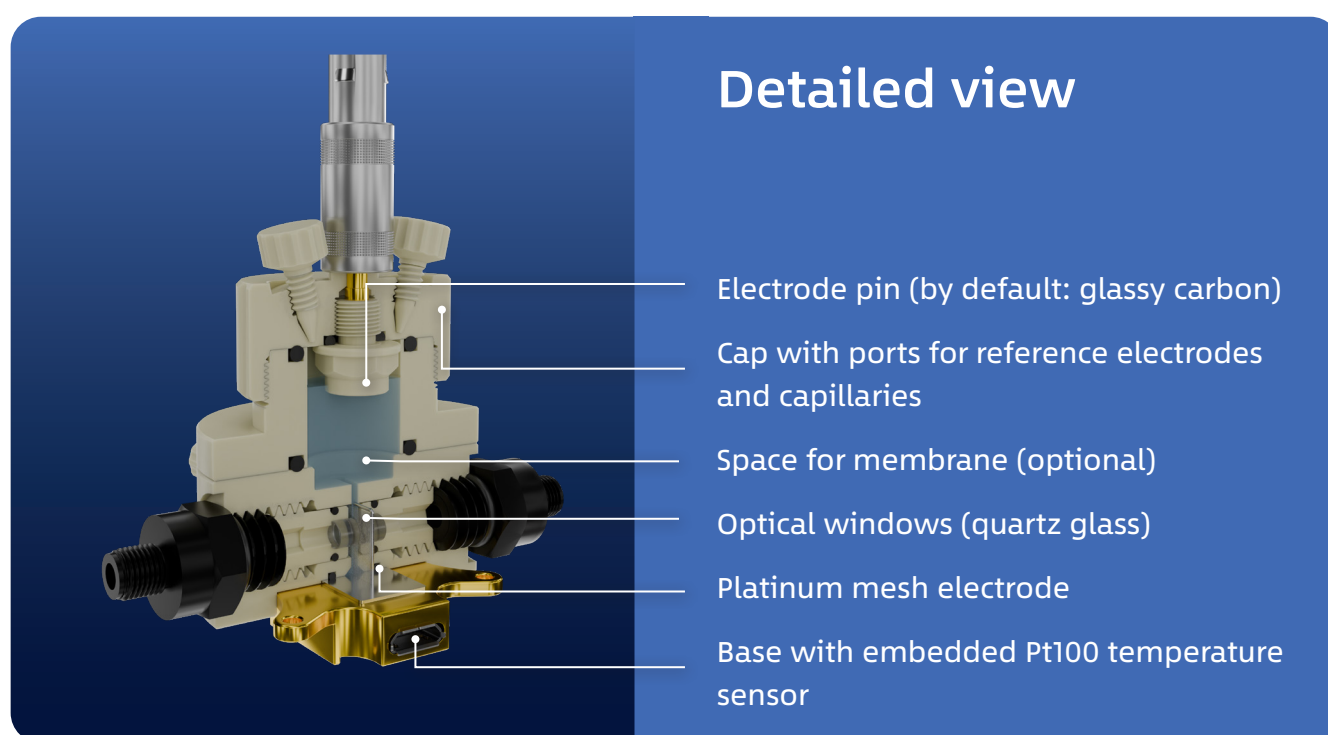
## Detailed description

This test cell has been designed for combining UV/Vis spectroscopy measurements in transmission with electrochemical methods. The test cell is air-tight, enabling the investigation of air- and moisture-sensitive samples. It comes with a Pt mesh working electrode being located in the optical path. The optical path length is flexible (max. 1.4 mm).

Optical fibre cables can be directly fixed to the test cell via SMA connectors. Besides two ports for the quartz glass windows, there is a third port to insert a reference electrode. An Ag-wire pseudo-reference electrode comes with the test cell. The test cell is sealed by a cap containing an exchangeable counter electrode tip made of glassy carbon press-fitted in PEEK (diam. 6 mm). Two tips with different lengths are part of the scope of delivery.

Other counter electrode materials are available on demand.

An electrolyte volume of 0.5 mL to 2.0 mL is required, depending on the chosen counter electrode tip length. As a special feature, the PEEK housing consists of two separate parts, allowing membranes to be placed between the working electrode in the lower cell compartment and the counter electrode in the cap.



## Selected technical specifications

<b>Suitable samples</b>	redox-active and UV/Vis-active species
<b>Temperature range</b>	-20 °C ... +80 °C
<b>Materials in contact with sample</b>	Pt, glassy carbon, quartz glass, PEEK, EPDM / FFKM
<b>Sample volume</b>	0.5 ml (long GC tip) or 2.0 ml (default GC tip)
<b>Pt mesh electrode</b>	152x152 wires/inch, 56% open area
<b>Options</b>	<ul style="list-style-type: none"> <li>• Alternative counter electrode materials</li> <li>• Re-fillable reference electrode</li> </ul>

# TSC Raman

## Test cell for in-situ Raman spectro-electrochemical experiments

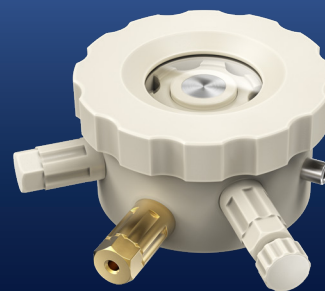
Benefit from this test cell to combine electrochemistry measurements with Raman spectroscopy.

- Robust, user-friendly design
- Customizable
- Air-tight: moisture- and air-sensitive samples can be studied



*„Just the right tool for my team.“*

**Assistant Professor**



## Typical applications

This versatile test cell can be used to perform in-situ Raman spectroelectrochemistry experiments to study interfacial processes between electrodes and liquid electrolytes in various applications.

- Investigation of the interface between electrode materials and electrolytes
- Study of corrosion processes at metal surfaces in contact with electrolyte solutions
- All types of light exposure and irradiation experiments

## Detailed description

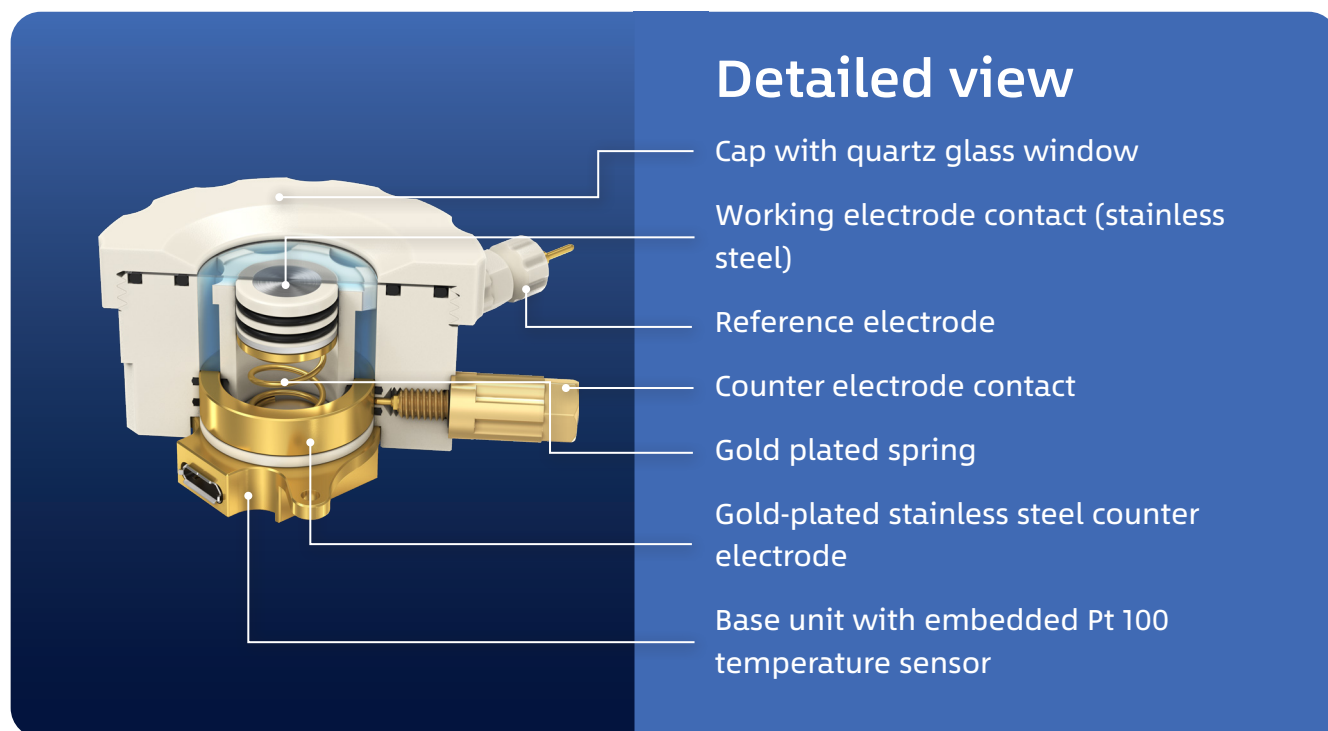
This test cell has been designed for in-situ Raman spectroscopy combined with electrochemical methods. The test cell is airtight and can be used to study air- and moisture-sensitive samples.

By default, the TSC Raman is provided with a working electrode contact made of stainless steel. The electrode material needs to be prepared as round-shaped specimen with an outer-diameter of max. 12.0 mm. The electrode material is placed on top of the working electrode contact. When as-



sembling the test cell, the sample is pressed against the optical window. In consequence, a very thin liquid film is formed on the working electrode, enabling the study of the solid-liquid interface. When a larger distance between the quartz glass window and the sample surface is required, a ring-shaped glass-fibre separator can be put

between the working electrode and quartz glass window. A gold-plated stainless steel ring electrode serves as counter electrode. An electrolyte amount of 2.0 ml is required. Lateral inlets enable the positioning of metal-wire based pseudo reference electrodes. In addition, these inlets also can be used for initial filling of the cell by means of the capillary-based filling set.



## Selected technical specifications

<b>Suitable samples</b>	Raman-active species and interfaces
<b>Max. temperature range</b>	+10 °C ... +40 °C
<b>Materials in sample contact</b>	Gold, PEEK, stainless steel 1.4404, quartz glass, FFKM, EPDM
<b>Electrolyte volume</b>	2.0 ml
<b>Requirements for working electrode material</b>	Discs with max. 12.0 mm diameter
<b>Thickness of quartz window</b>	0.5 mm
<b>Options</b>	WE contact with fixed height, customized versions of the test cell, glassy carbon counter electrode ring

# TCE Cell One

## Test cell for studying membranes and separators

Benefit from this innovative test cell which can be split into two compartments by inserting a membrane or separator material.

- Double-chamber test cell which can be split into two compartments by inserting a membrane or separator material
- Exchangeable electrodes: broad portfolio of available electrode materials
- Ports in the housing for inserting capillaries or reference electrodes
- Air-tight: moisture- and air-sensitive samples can be studied



*„Easy to handle  
solution for testing  
my membranes “*

**Membrane Engineer**



## Typical applications

- Membrane and separator testing (permeability, conductivity)
- Liquid electrolytes testing (e.g. conductivity)
- Investigation of redox reactions
- Investigation of solid electrolytes being in contact with liquid electrolytes

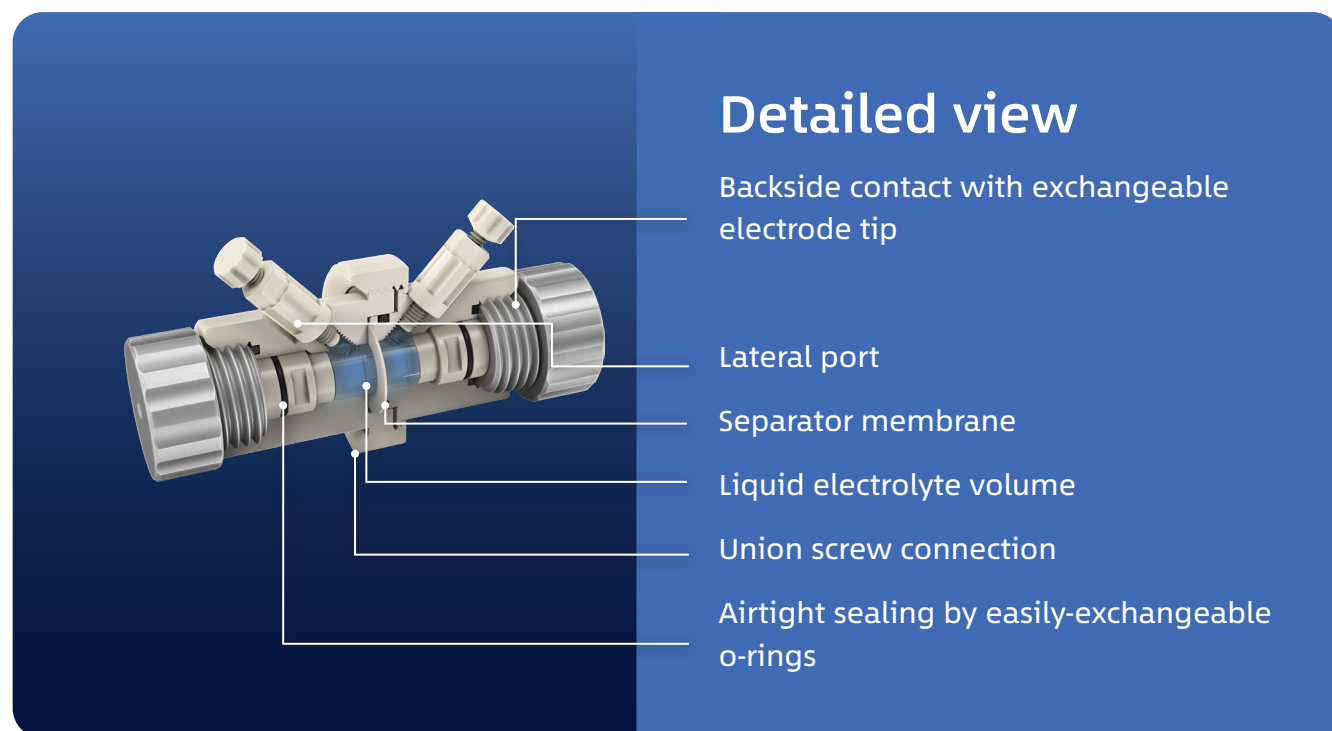
## Detailed description

The TCE Cell One requires only a low amount of liquid electrolyte (approx. 1.8 ml) which can be split into two compartments when inserting a membrane, separator foil or solid ion conductor. Depending on the experiment, the test cell can be used with or without a membrane. Two ports on each side of the cell's corpus provide inlets for inserting reference electrodes, filling the cell with electrolyte, or purging the electrolyte with gas.

The current collector design allows for using different electrode materials and switching between them easily. We also offer current collectors with stainless steel (1.4404) as

core material and PEEK punching edges which allows for using metallic lithium or sodium as electrode materials. The TCE Cell One is delivered without electrodes. Electrodes with core material of your choice

have to be ordered separately. For assembling the TCE Cell One, no tools or screws are required. The TCE Cell is air-tight, and therefore measurements of air- and moisture-sensitive samples are possible.



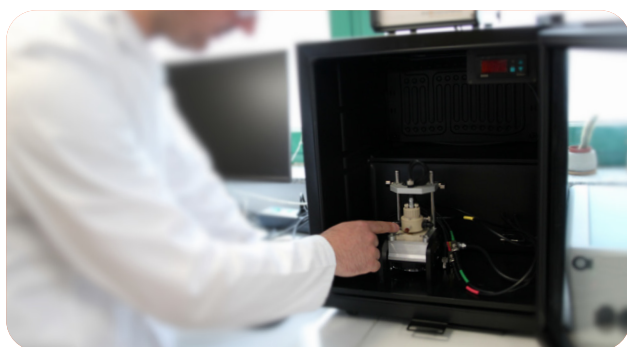
## Selected technical specifications

<b>Suitable samples</b>	Polymeric foils, membranes, solid electrolyte pellets, liquid electrolytes
<b>Temperature range</b>	-40 °C ... +100 °C
<b>Required electrolyte volume</b>	approx. 1.8 ml
<b>Materials in sample contact</b>	selected electrode material, PEEK, FFKM, EPDM
<b>Min./Max. membrane diameter</b>	12.0 mm / 20.0 mm
<b>Max. membrane thickness</b>	1.0 mm
<b>Available electrode materials</b>	Stainless steel 1.4404, platinum, gold, glassy carbon
<b>Reference electrode options</b>	Metal-wire pseudo-reference electrode

# rhD Cooling Box

## Accessory for low temperature measurements with the Microcell HC setup

- Lowers dew point and ambient temperature while operating the Microcell HC setup
- Contains cable feedthrough for the Microcell HC setup
- Contains a temperature controller unit with display to set temperatures of the box
- Easy to use device: plug-and-play



*„An easy to use device helping me to measure at low temperatures “*

**PhD Student**



## Typical applications

The rhD Cooling Box has been designed as a supporting tool for the Microcell HC setup for different applications

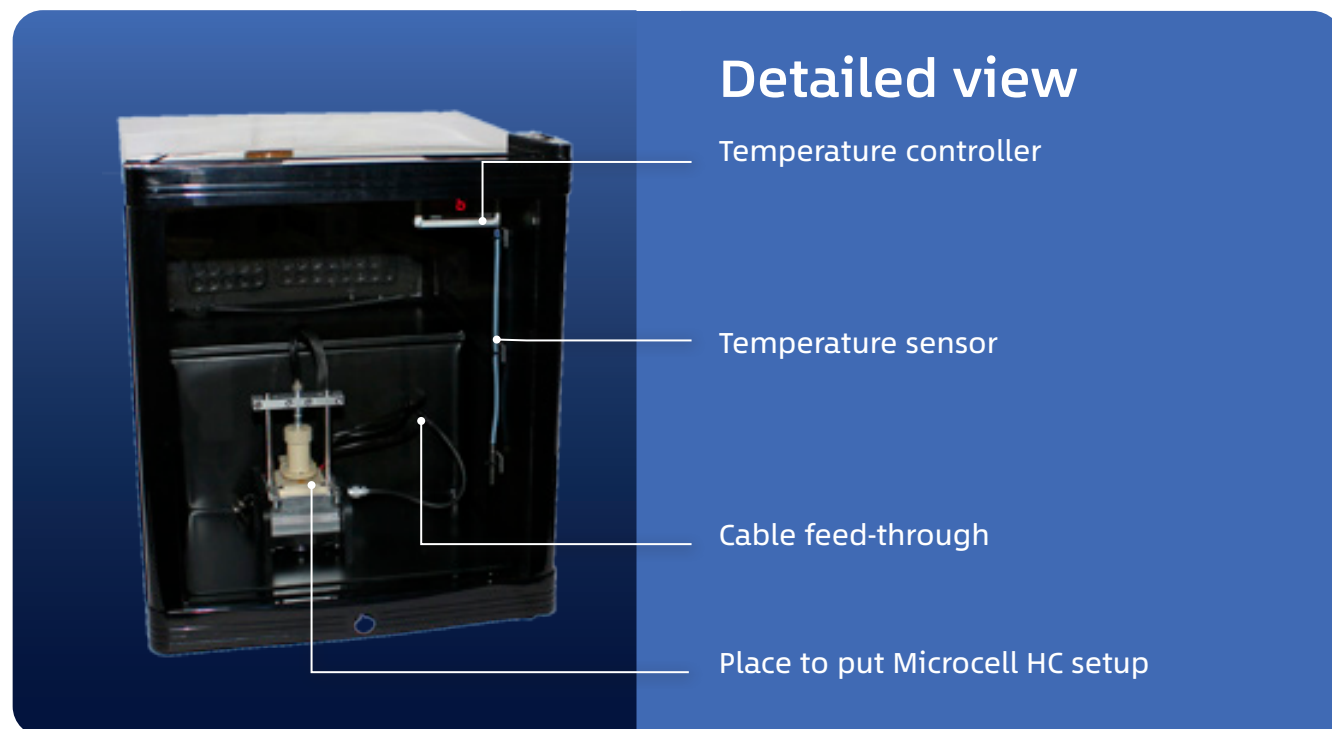
- Long-term measurements down to  $-40^{\circ}\text{C}$
- Determination of the temperature-dependent conductivity of liquid, gel-like, polymeric, and solid electrolytes
- Performing temperature-dependent cyclic voltammetry measurements
- Charging/discharging of batteries and supercaps at different temperatures



## Detailed description

The rhd Cooling Box is designed to allow the Peltier element of the Microcell HC cell fixture to cool the sample to the lowest possible temperatures by lowering the ambient temperature and lowering the dew point to avoid ice formation.

It consists of a cooling box cabinet with enough space to place one Microcell HC setup, a temperature controlling unit to set min. and max. temperature values, and a cable feedthrough providing all cables being necessary for operating the Microcell HC setup.



## Selected technical specifications

<b>Line voltage</b>	U <sub>ac</sub> , rms = 230 V / 50 Hz Power converter to 110 V available upon request
<b>Energy consumption</b>	0,6 kWh/d
<b>Size and weight</b>	51 cm x 43 cm x 48 cm (L x W x H), 18 kg
<b>Refrigerant</b>	R600a (18 g)
<b>Ambient temperature</b>	16° C ... 32° C

# RelaxIS3

Impedance Spectrum Analysis



## RelaxIS

### Versatile software for analyses in electrochemical impedance spectroscopy

Get inspired by RelaxIS – our proven stand-alone software for analysing electrochemical impedance spectroscopy measurements. It is compatible with most major-brand ana-

lyser data formats. Optimised for working with many spectra at a time, RelaxIS' analysis functions can be applied quickly to a full measurement series.

- Compatible with practically all EIS analysers
- Offers both common and advanced analysis techniques
- Customisable in many areas with a powerful plug-in system
- Available for Microsoft Windows 10 / 11

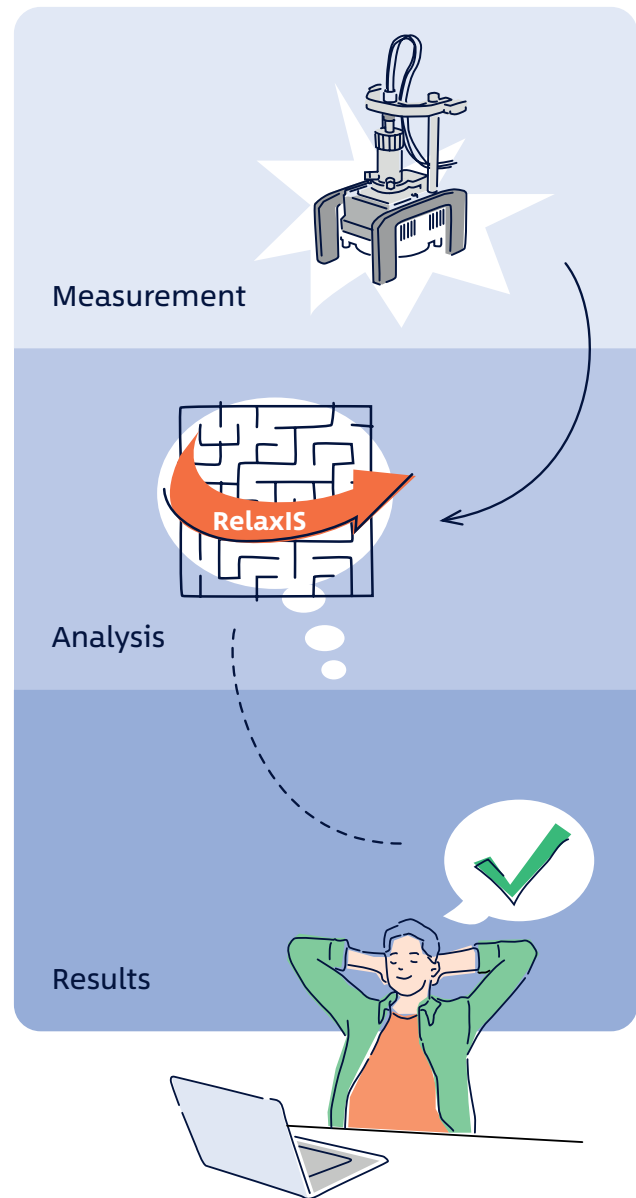
# RelaxIS3 - Impedance Spectrum Analysis

## High quality measurements need equally high quality data analysis.

RelaxIS - Impedance Spectrum Analysis is a fast and powerful software solution for analyzing electrochemical impedance spectra.

It allows for quick and comfortable evaluation of large amounts of spectra by combining powerful fitting algorithms with a modern user interface. RelaxIS supports a broad variety of file formats from different hardware manufacturers as well as arbitrary text formats. Files can be loaded by simple drag & drop operations. It is possible to perform automatic fitting against different standard models as well as using arbitrary, user-defined equivalent circuits.

Multiple advanced features like DRT analysis, live preview of fit results, fitting of temperature-dependent data to Arrhenius and VFT functions, a circuit simulator and powerful export capabilities make RelaxIS a valuable asset for everyone using impedance spectroscopy.

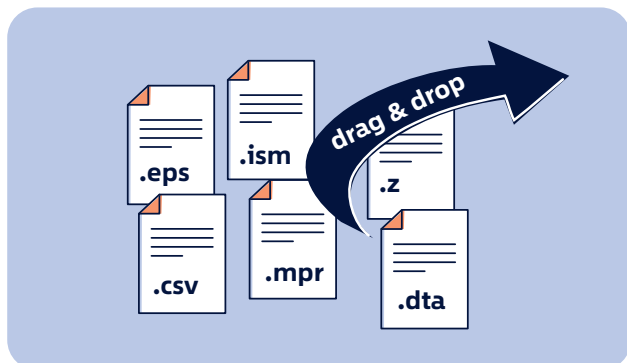


**RelaxIS3**  
Impedance Spectrum Analysis

**RelaxIS - Impedance Spectrum Analysis eases the evaluation of measured impedance data.**

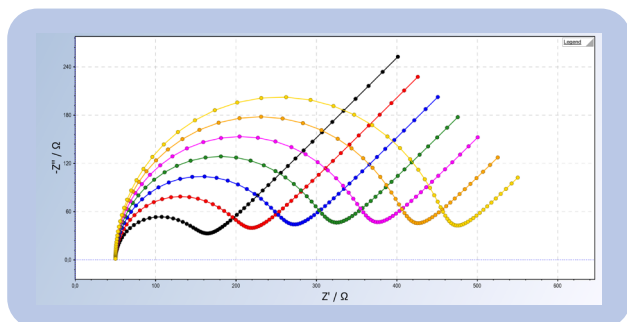
Focus your attention on the results and not on how to obtain them.

## Simple file management



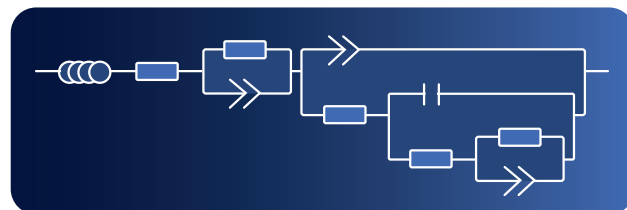
- Import more than ten different data file formats or arbitrary text files.
- Simple drag & drop operation.
- Read and use additional information from data files like temperature or DC bias.
- Easily duplicate or merge data files as needed.

## Visualize, fit and compare



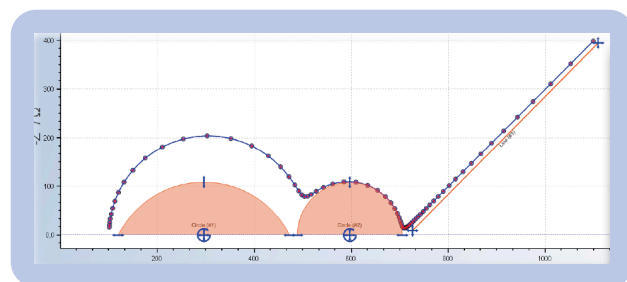
- Visualize your spectra in multiple different representations like Nyquist or Bode plots.
- Display and fit data in the impedance, complex capacitance or admittance plane.
- Create an overlay of multiple spectra for easy comparison.

## The perfect circuit for your task



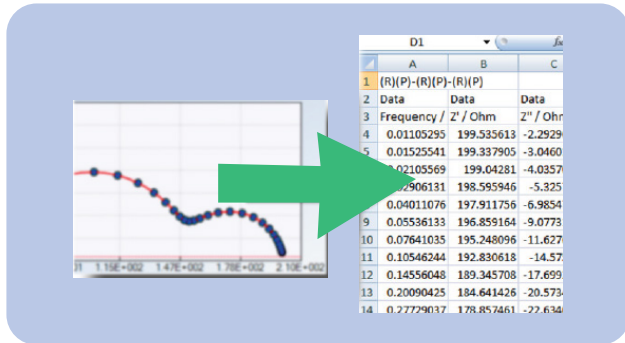
- Use a large library of more than 70 pre-made, common equivalent circuits.
- Quickly create your own arbitrary circuits.
- Create new circuit elements<sup>SDK</sup> to solve your tasks.

## Accelerate analysis



- Use a combination of some of the most powerful fitting algorithms and data weighting options.<sup>SDK</sup>
- Utilize the Auto Fit to avoid parameter initialization.
- Draw impedance circles and lines directly into your data.
- Save precious time by using batch fitting methods.
- Use RelaxIS as a central data server with RelaxIS Remote and RelaxIS WCF Link.<sup>SDK</sup>

## Analyze, correlate, and export your data

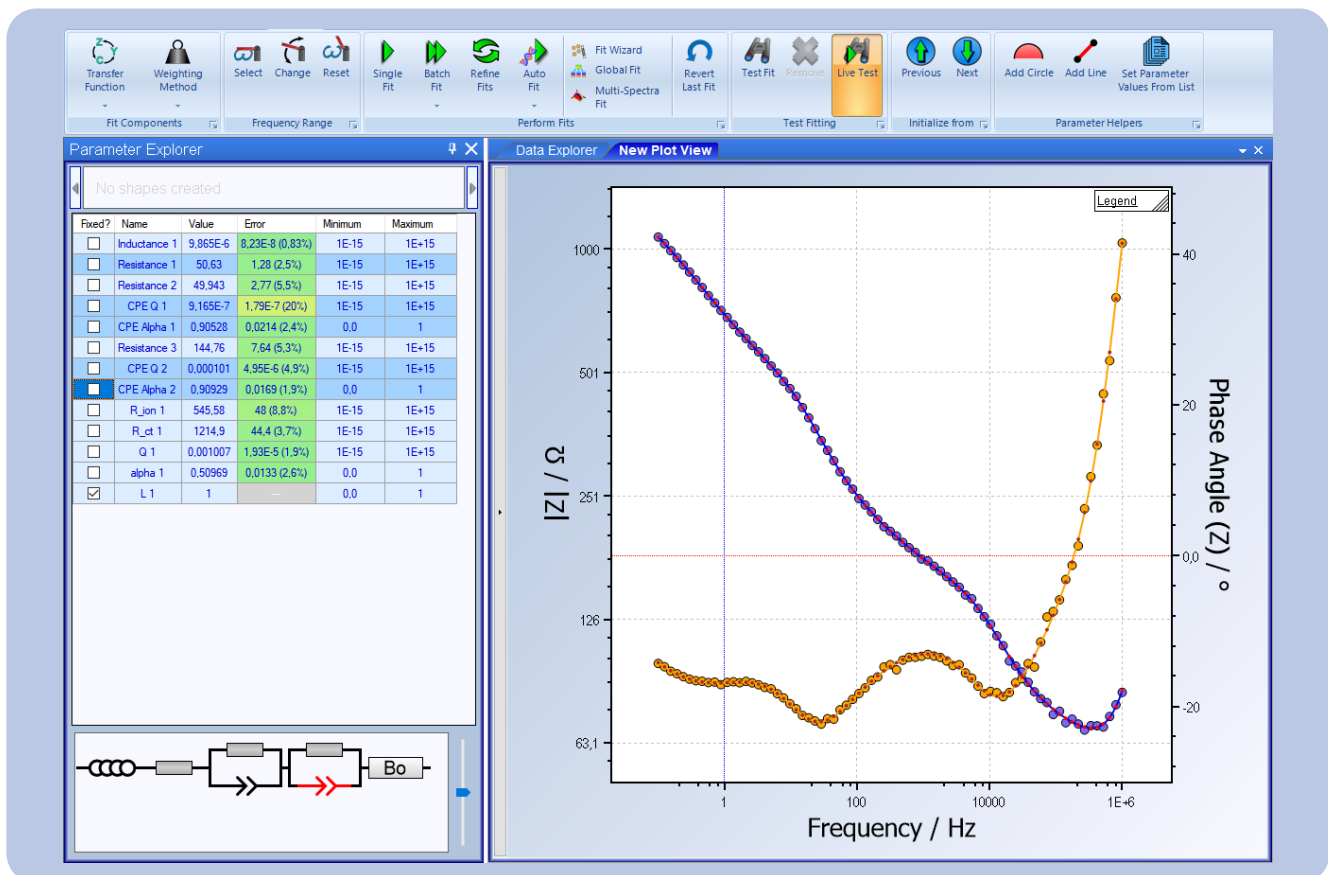


- Create further evaluations<sup>SDK</sup> of fit parameters as a function of metadata.
- Evaluate temperature dependent data by integrated Arrhenius and VFT fitting routines.<sup>SDK</sup>
- Export any type of data into text formats for use in third-party programs.
- Export graphs or equivalent circuits directly as images for use in presentations.


## Simulate, analyze, and extend



- Simulate arbitrary equivalent circuits with free options in the RelaxIS Circuit Simulator.
- Dive deep into your data with innovative DRT analysis.
- Determine the quality of your data by linear Kramers-Kronig testing and residual analysis.
- Extend RelaxIS with your own plugins using the RelaxIS Software Development Kit, SDK.







*"Quality and innovation  
are in our DNA. It's what  
makes rhd instruments  
a trusted name in  
electrochemistry."*

**Dr. Marcel Drüschler**

# A selection of our customers and partners

Globally leading industrial and academic R&D facilities already trust in our hardware and software solutions, as well as in our abilities as a reliable partner and advisor for electrochemical testing.

**BASF**  
We create chemistry

**DAIKIN**  
AIR INTELLIGENCE



**HIU** HELMHOLTZ  
INSTITUTE  
ULM  
Electrochemical Energy Storage

Kettering  
UNIVERSITY

**Leclanché**  
Energy Storage Solutions

**li.u** LINKÖPING  
UNIVERSITY

**MERCK**

FRIEDRICH-SCHILLER-  
UNIVERSITÄT  
JENA

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