PORTFOLIO
2025

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NEXT GENERATION BATTERY CELL TESTING

2025

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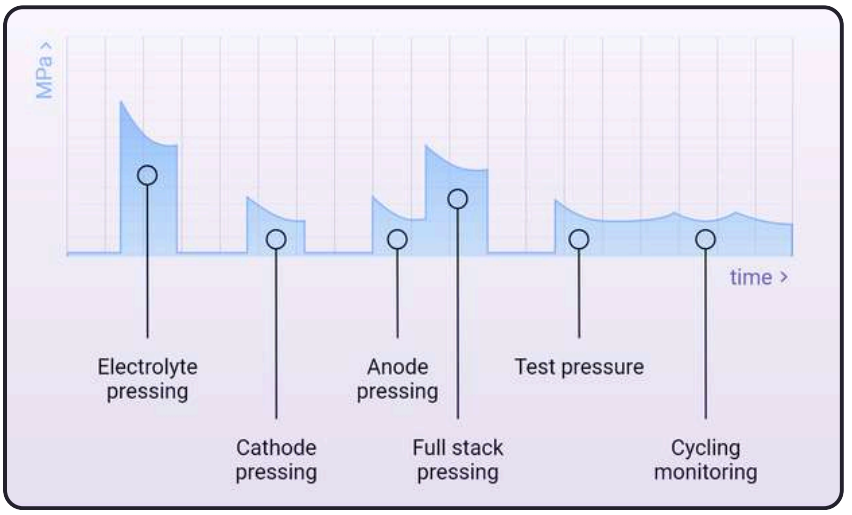
FOCUS AREAS IN SOLID-STATE BATTERY RESEARCH

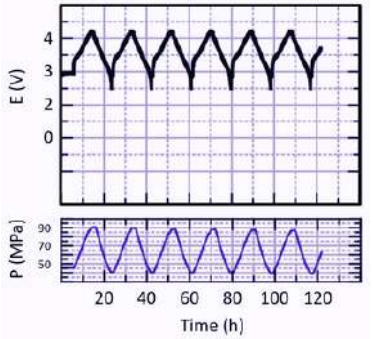
The field of solid-state battery research often faces the challenge of conducting electrochemical tests on complex samples under specific mechanical conditions. Sphere Energy has responded to this challenge by designing a range of testing equipment that is customized to meet the requirements of experiments in this area of research. Our equipment is designed to provide support in various aspects, including sample preparation, pressure, and thickness monitoring, making testing more convenient and streamlined.



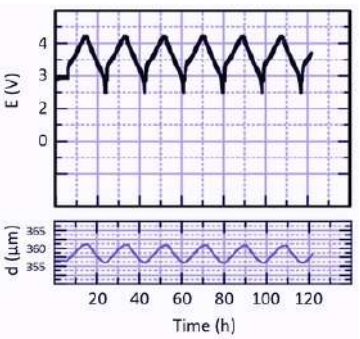
Key aspects for reproducibility and data reliability
Pressure tracking from the initial state of sample preparation until the end of the electrochemical tests.

Direct access to relevant data

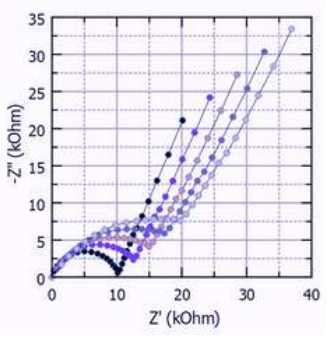
We have designed our setups to offer you convenient access to essential data while conducting tests on solid-state battery materials. Through our testing cells, pressure can be monitored not only during the sample preparation protocol but also along the entire electrochemical test phase, generating important insights about the electro-chemo-mechanical performance of your studied systems.



Pressure monitoring data of electrochemical tests.



Sample size (thickness) monitoring during electrochemical tests.



EIS measurements of a sample over different temperatures.

Pressure, thickness, and temperature are some of the parameters covered by our setup. You will find many other options to enrich your R&D activities in the following pages of this catalog. Enjoy it!

SIMPLIFYING RESEARCH WITH PRECISION AND PERFORMANCE

Compact & Lab-Optimized Design

- Product dimensions designed for optimal use under lab conditions.
- Perfectly suitable for glove-box handlings and transfers.
- User-friendly assembly.

Simple usability under difficult conditions

- Reproducible results by monitoring all important parameters during testing and preparation steps.
- Prepare battery materials at their measurement location to avoid cross-contamination and pellet damage.
- A broad range of features covering: airtight cells, fixed distance pressurization, dynamic pressure management, gas analysis, temperature control, resistance measurement probe, reference-electrode, pressure and thickness monitoring.
- Simplified sample material loading thanks to the symmetric cell design.
- Long-lasting design thanks to high-end materials and replaceable wear parts.
- Time-saving mechanisms paving the way to high throughput battery testing

Modular approach

- The ASC family is made from intercompatible products - so you can easily enlarge your testing possibilities whether it's by integrating new modules, expanding sample sizes or incorporating real-time environmental monitoring systems.

COMPLETE SOLUTIONS FOR SOLID-STATE & POUCH CELL TESTING

01 ELECTROCHEMICAL TEST UNDER PRECISE SAMPLE GEOMETRY AND PRESSURE CONTROL

PRESSURE BEHAVIOUR OF SAMPLES DURING TEST

All ASC setups facilitate solid-state battery sample preparation by enabling in-situ pelletization of complex material layers. Integrated pressure monitoring allows continuous tracking during sample formation and testing.

*Adapted setups: ***ASC-T+ / ASC-AD+ / ASC-X / ASC-AD / ASC-G / ASC-C / ASC-P+***
In combination with ASC pressure frame

02 SWELLING TESTS UNDER FIXED PRESSURE PROTOCOLS

VOLUME EXPANSION AND CONTRACTION DURING ELECTROCHEMICAL TESTS

In order to get insights into breathing and swelling behavior of battery cells during electrochemical tests, our setups can be combined with thickness monitoring options and the pressure can be applied via springs for fixed pressure testing protocols.

*Adapted setups: ***ASC-T+ / ASC-AD+ / ASC-X / ASC-P+***

03 IONIC CONDUCTIVITY MEASUREMENTS

EIS MEASUREMENTS WITH PRECISE PRESSURE CONTROL AND THICKNESS MONITORING

Our systems enable accurate monitoring of sample dimensions under applied pressure, allowing for precise correlation with impedance values and enabling exact estimations of ionic conductivity in your experiments.

*Adapted setups: ***ASC-T+ (practical for Arrhenius plots) / ASC-X***

04 ADVANCED ELECTROCHEMICAL TESTS WITH REFERENCE-ELECTRODE

ANODE AND CATHODE DECONVOLUTED VOLTAGE INFORMATION

The ASC-T+ is equipped with metallic-based reference-electrode embedded in the internal insulation sleeve and placed at the center of the sample.

*Adapted setups: ***ASC-T+***

05 ADVANCED CHARACTERIZATION VIA GAS ANALYSIS

REALTIME GAS ANALYSIS OF DECOMPOSITION REACTIONS DURING ELECTROCHEMICAL TESTS

The ASC-G's built-in gas flow channels enable direct and efficient interfacing with gas analysis equipment for comprehensive gas evaluation in electrochemical tests.

*Adapted setups: ***ASC-G***

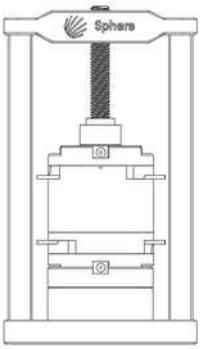
COVERING KEY ASPECTS OF YOUR RESEARCH

OVERVIEW OF PARAMETERS COVERED BY SPHERE'S SETUPS

Type	Technical purpose	Technical purpose	Pressure application	Airtightness	Max pressure/force	Pressure monitoring	Swelling monitoring
ASC-X		Screeing tests	Fixed thickness	Yes	400 MPa	Optional	Optional
ASC-AD		Long term testing	Fixed thickness	Yes	400 MPa	No	No
ASC-G		Mass spectroscopy	Fixed thickness	Yes	400 MPa	Optional	Optional
ASC-T+		Advanced tests and high temperature	Fixed thickness Or fixed pressure	Optional	400 MPa	Yes	Optional
ASC-AD+		Low pressure range	Fixed thickness Or fixed pressure	Yes	100 MPa	Yes	Optional
ASC-P		Pouch format	Fixed thickness fixed pressure or hybrid	No	20 kN	Optional	Optional
ASC-P+		Pouch format	Fixed thickness fixed pressure or hybrid	No	20 kN	Optional	Optional

FOR SOLID-STATE BATTERY TESTING EQUIPMENT

Precision Testing for Innovative Energy Materials



Dimensions: 210 x 120 x 100 mm
Weight: 5.5 kg
Pressure range: 0-400 MPa
Temperature range: 25 to 200°C

The ASC-T+

Advanced tests on solid-state batteries and battery materials

The ASC-T+ is a versatile setup designed specifically for tests on solid-state battery research. It provides great flexibility to meet various research requirements, which is crucial in this fast-evolving battery industry.

The setup comes with a built-in temperature control system, ensuring accurate experiments up to 200°C. Pressure application and monitoring are achieved through the use of a mechanical press (pressure frame) also provided with the setup.

Additionally, the system is capable of accommodating multiple sample sizes, ranging from 8 mm to 14.5 mm, resulting in a 3.3 times increase in the active surface area. This adaptability is essential for the development of new materials and advanced battery systems.

MAIN FEATURES

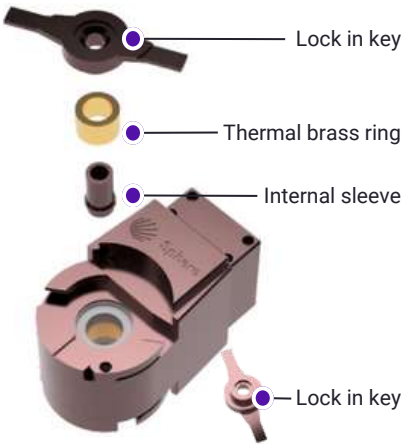
- Multiple sample sizes
- Pressure Monitoring
- Temperature control
- Exchangeable int. sleeves
- Reference electrode
- Compact dimensions
- Fixed pressure mode

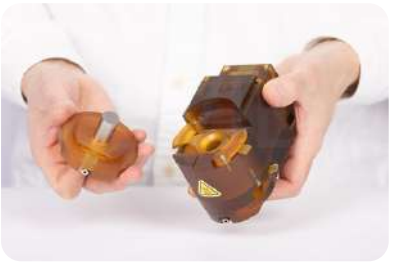
ADD-ON OPTIONS

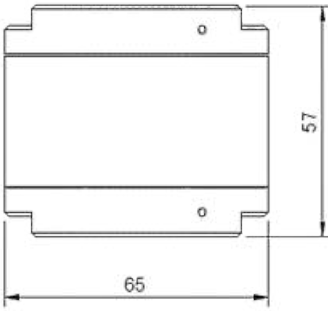
- Fixed thickness mode
- Swelling monitoring
- Multiple spring constants
- 4-point probe resistivity

ASC-T+ setup contains:

1x ASC-T+ test cell equipped with built-in temperature control system
1x Set of pistons and internal sleeves for multiple sample diameters (8, 10, 12 and 14.5mm)
1x Ceramic sleeve for samples of 8 mm of diameter
1x Internal sleeve with reference-electrode based on Cu
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Pressure frame equipped with a pressure sensor for material pressing and pressure monitoring
1x Control unit equipped with a temperature control system, pressure display and analogical output for pressure data transmission to potentiostat, cycler or computer
1x Glove box feedthrough adaptor, set of cables and connection leads







Dimensions: 65 x 65 x 57 mm
Weight: 750 g
Pressure range: 0-400 MPa
Temperature range: -20 to 120°C

The ASC-X

Precision Airtight Testing with Interchangeable Pistons

The ASC-X is a new generation electrochemical cell developed to meet the rigorous demands of solid-state battery R&D. Designed for precision under extreme conditions, ASC-X enables researchers to apply and control pressures of up to 400 MPa within an airtight environment—crucial for probing the mechanical and electrochemical interplay in solid-state systems. Its flexible sample holder accommodates diameters from 8 to 12 mm, supporting both material-scarce fundamental studies and signal-intensive advanced testing. Whether working with minimal material quantities or exploring larger interfaces, ASC-X adapts to the evolving challenges of solid-state innovation.

What truly sets ASC-X apart is its redesigned sealing mechanism that decouples the pressure applied to the sample from that applied to the ferrules. This novel architecture ensures highly accurate and consistent pressure control, essential for reproducibility and in-depth analysis. Its small form factor and simplified assembly protocol reduce setup time, enabling more consistent results under controlled conditions. With ASC-X, researchers can now focus on what matters most: unlocking the next breakthroughs in solid-state battery performance.

MAIN FEATURES

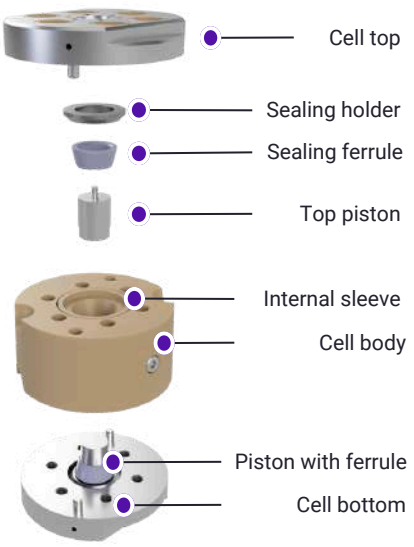
- Airtight Precision Design
- Rapid Interchangeable Pistons (8, 10, 12 mm)
- Fixed thickness mode
- Exchangeable int. sleeves
- Enhanced Reproducibility

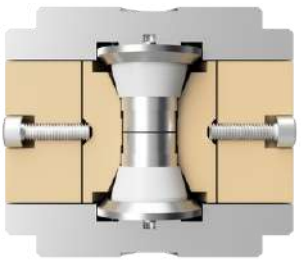
ADD-ON OPTIONS

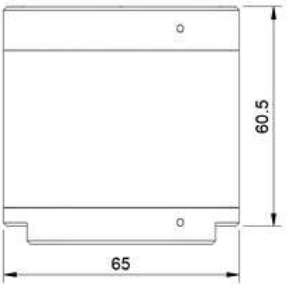
- Pressure monitoring
- Swelling monitoring
- Fixed pressure mode
- Multiple spring constants

ASC-X setup contains:

1x ASC-X test cell
1x Set of pistons and internal sleeves for multiple sample diameters (8, 10, 12 mm)
1x Torque wrench for manual pressure setting
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Set of tools, sealing ferrules and cables







Dimensions: 65 x 65 x 60.5 mm
Weight: 770 g
Sample preparation: 0-400 MPa
Test with constant P: 5-100 MPa
Temperature range: -20 to 120°C

The ASC-AD

Airtight electrochemical cell for tests under constant pressure

The ASC-AD is a practical setup for electrochemical tests under stable conditions of applied pressure. This setup offers an active pressure balancing system, ensuring that the initially set stacking pressure is kept constant during the expansion or contraction of the tested materials. This is key for optimal results in long-term electrochemical cycling.

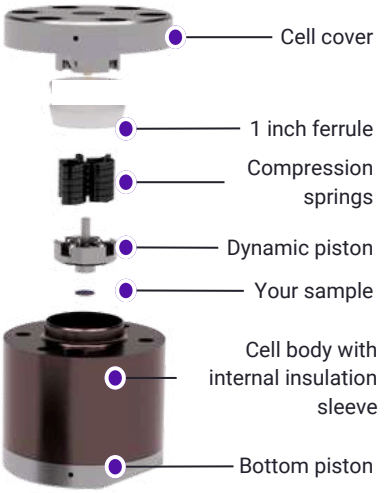
The dynamic pressure applied during the tests can be perfectly customized from 5 to 100 MPa via a variety of plungers and a selection of springs having different spring coefficients. During the sample preparation phase, the setup can apply up to 400 MPa using the pressure tool delivered with the setup. This setup is also airtight based on Swagelok ferrules and can be used for testing air-sensitive materials outside the glove box.

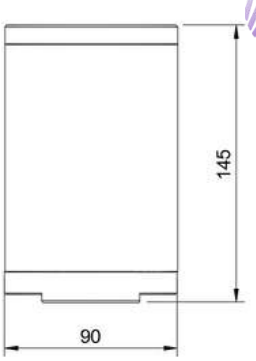
The ASC-AD can be used in combination with the pressure frame for sample preparation only, for example during the stage of sample densification inside the glove box. Once the cell is assembled with the sealing ferrules, it becomes a stand-alone testing cell for electrochemical tests.

MAIN FEATURES
- Airtight
- Large pressure range
- Fixed pressure mode
- Sample diameter 8 mm
- Exchangeable int. sleeves

ADD-ON OPTIONS
- Multiple spring constants

ASC-AD setup contains:
1x ASC-AD electrochemical test cell
1x Compression tool
3x Dynamic plungers with different lengths
2x Internal sleeves in PEEK for samples of 8 mm of diameter
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Set of tools, springs, sealing ferrules and cables





Dimensions: 90 x 90 x 145 mm
Weight: 2.2 kg
Pressure range: 0-100 MPa
Temperature range: -20 to 75°C

The ASC-AD+

Airtight electrochemical testing cell tailored for low-pressure conditions and under multiple cell configurations

The ASC-AD+ is our latest product for solid-state battery testing, designed to effortlessly explore multiple sample dimensions while providing crucial data on pressure and swelling through a streamlined, user-friendly interface.

This airtight setup allows for increasing the surface area of the samples up to 3.3-fold. The built-in pressure sensor generates real-time pressure information during the tests. All this with the possibility of tuning the setup for experiments under various pressure values, from a few kPa to 100 MPa, via the fixed thickness mode (pistons blocked) or via the constant pressure mode (piston connected with spring).

The ASC-AD+ setup can also be equipped with a thickness monitoring system for precisely tracking the swelling of battery cells, providing valuable insights into the mechanical properties of battery materials.

MAIN FEATURES

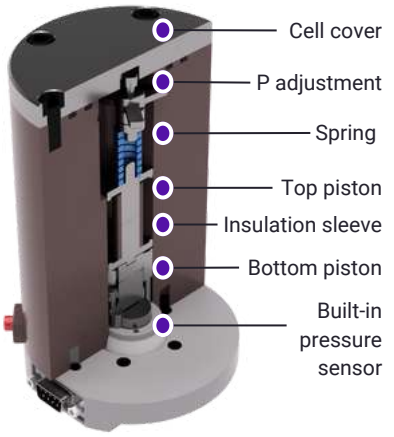
- Multiple sample sizes
- Pressure monitoring
- Swelling monitoring
- Built-in pressure sensor
- Fixed thickness mode
- Fixed pressure mode
- Exchangeable int. sleeves
- Multiple spring constants

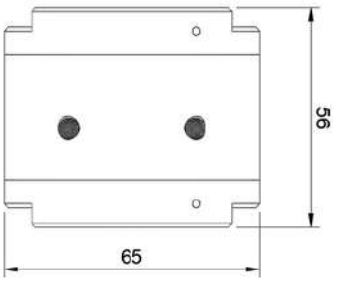
ADD-ON OPTIONS

- Swelling monitoring

ASC-AD+ setup contains:

1x ASC-AD+ electrochemical test cell
1x Control unit equipped with pressure display and analogical output for pressure data transmission to potentiostat, cycler or computer
1x Set of pistons and internal sleeves for multiple sample diameters (8, 10, 12 and 14.5mm)
1x Glove box feedthrough adaptor
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Set of loading tools and adaptors for sample preparation
1x Set of tools, springs, sealing o-rings and cables





Dimensions: 65 x 65 x 56 mm
Weight: 740 g
Pressure range: 0-400 MPa
Temperature range: -20 to 80°C

The ASC-G

Airtight electrochemical test cell equipped with gas flow channels for combined gas analysis

The ASC-G is designed to combine the functionalities of our setups with an external gas analysis characterization technique, enabling real-time analysis of decomposition reactions and gasses released during your electrochemical measurements.

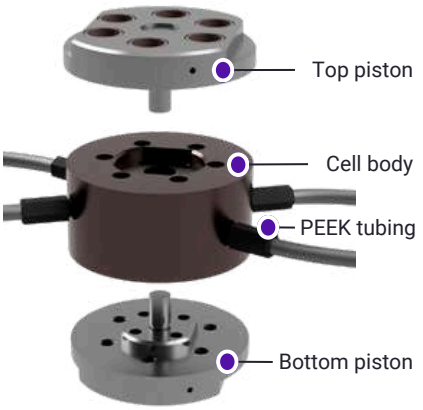
The setup is equipped with four gas channels that can be used in multiple configurations, for example for separating the gasses from anode and cathode reactions.The gas flow circulating in the channels is distributed inside the cell through a small gap placed between the pistons and the internal wall of the cell.

The setup comes with a calibrated torque wrench and a table that correlates torque values with pressure, which enables precise adjustment of the internal pressure at the sample level.

MAIN FEATURES
- Gas flow channels
- Airtight
- Large pressure range
- Fixed thickness mode
- Sample diameter 8 mm

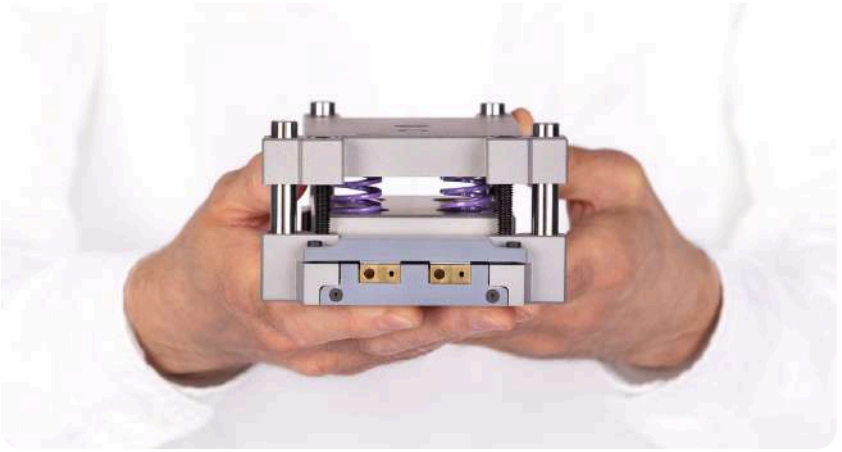
ADD-ON OPTIONS
- Pressure monitoring
- Swelling monitoring
- Fixed pressure mode
- Multiple spring constants

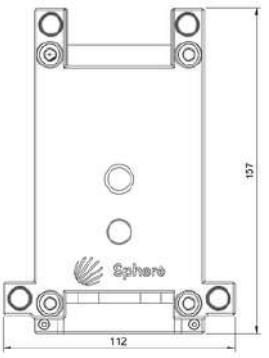
ASC-G setup contains:
1x ASC-G electrochemical test cell
1x Torque wrench for manual pressure setting
4x Inlet/outlet tubes in PEEK with 50 µm of internal diameter
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Set of tools, sealing ferrules, channel stoppers, cables and accessories



FOR POUCH CELL TESTING EQUIPMENT

Optimized Solutions for Pouch Cell Evaluation





Dimensions: 157 x 112 x 70.5 mm
Weight: 3.8 kg
Force range: 0-20 kN
Temperature range: -20 to 80°C

The ASC-P

Battery pouch cell testing setup

The ASC-P is a specialized setup for battery researchers focused on prototyping, enabling precise control over the pressure applied to pouch cells. Its design allows for fine-tuning of mechanical stress simulations through adjustable pressure screws and springs, crucial for testing battery durability and performance. This system simplifies the electrical connection to testing devices with its intuitive tab contacts, ensuring reliable data collection.

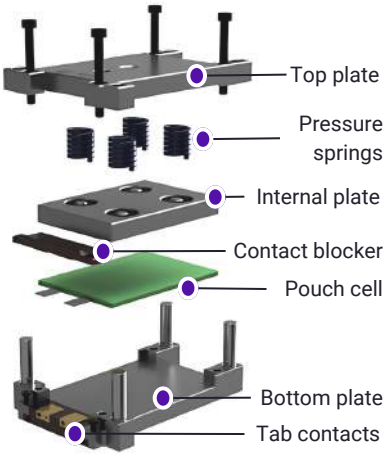
In its versatile operation, the ASC-P features two modes: fixed thickness and fixed pressure, each catering to different experimental needs. The fixed thickness mode offers insights into the cell's behavior under constant dimensions, while the fixed pressure mode, with adjustable spring coefficients, accommodates variations in cell thickness, ensuring consistent pressure. This adaptability makes the ASC-P an indispensable tool for researchers aiming to push the boundaries of battery innovation.

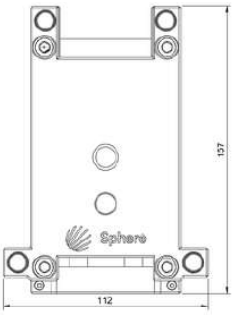
Additionally, the ASC-P offers the possibility for precise pressure control and monitoring when coupled with the ASC pressure frame, or via a built-in pressure sensor. The setup can also be equipped with a thickness monitoring system for tracking the swelling of the cells assessing valuable information about volume expansion.

ASC-P setup contains:
1x ASC-P testing setup
1x Torque wrench for manual pressure application
1x Set of medium-force springs (spring rate 216N/mm)
1x Set of low-force springs (spring rate 98N/mm)
1x Set of extra low-force springs (spring rate 32N/mm)
1x Set of tools, screws and accessories

MAIN FEATURES
- Fixed thickness mode
- Fixed pressure mode
- Multiple spring options
- Facilitated tab connection
- High force (up to 20 kN)
- Max cell size 108 x 75 x 8
- Compatible with ASC pressure frame

ADD-ON OPTIONS
- Pressure monitoring
- Swelling monitoring
- Built-in pressure sensor





Dimensions: 157 x 112 x 100 mm
Weight: 4.8 kg
Force range: 0-20 kN
Temperature range: -20 to 80°C

The ASC-P+

Precision Testing with Real-Time Pressure Control

Meet the ASC-P+, our compression jig dedicated to pouch and prismatic cell testing. Designed for precision, this upgraded setup comes equipped with a built-in pressure monitoring system that provides real-time data — giving you unparalleled control over pressure dynamics throughout your cell testing. With this system, you'll gain immediate insights, helping you fine-tune your experiments and optimize battery cell performance.

The ASC-P+ adapts to your research needs with fixed pressure and fixed thickness modes, along with adjustable spring options that help you maintain consistent pressure during cell swelling. Whether you're studying cell degradation, mechanical stress, or performance under varied conditions, the ASC-P+ ensures accurate and reproducible results.

The ASC-P+ is a compact system engineered for efficiency. It combines robust performance with a user-friendly design, providing cutting-edge additional functionalities such as swelling monitoring via thickness, pressure and temperature mapping, and control over cell heat extraction. For researchers seeking to demonstrate breakthroughs in battery cell technology over prototype cell sizes, the ASC-P+ offers the precision and adaptability required to advance your work.

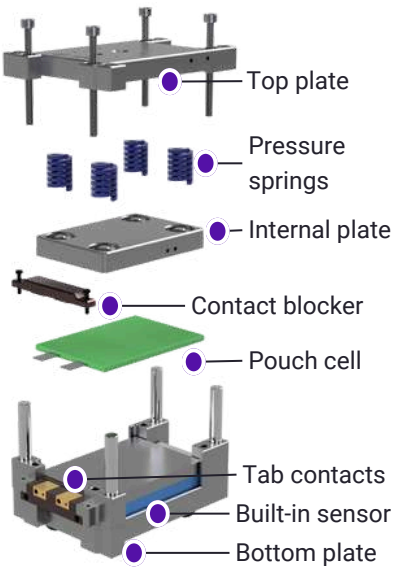
MAIN FEATURES

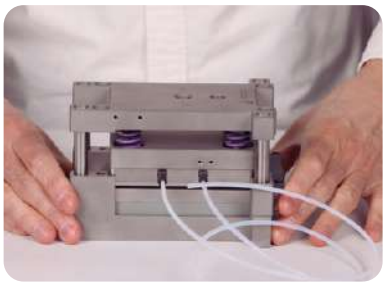
- Pressure monitoring
- Fixed thickness mode
- Fixed pressure mode
- Multiple spring options
- Facilitated tab connection
- High force (up to 20 kN)
- Max cell size of 108 x 75 x 8 mm

ADD-ON OPTIONS

- Swelling monitoring
- Pressure mapping
- Temperature mapping

ASC-P+ setup contains:
1x ASC-P+ testing setup
1x Built-in pressure sensor
1x Analogical data output
1x Set of medium-force springs (spring rate 216 N/mm)
1x Set of low-force springs (spring rate 98N/mm)
1x Set of extra low-force springs (spring rate 32 N/mm)
1x Set of tools, screws and accessories





Pressure applied via a fixed thickness mode

The ASC-P+ offers users the flexibility to select different methods of applying pressure to cells during testing. The "fixed thickness mode" is designed to maintain a constant distance between the compression plates, secured by pressure screws. In this setup, the cell's swelling is restricted by the fixed position of the plates, leading to significant pressure variations throughout charge and discharge cycles. The plot below illustrates these pressure fluctuations in a Li-ion battery cell.

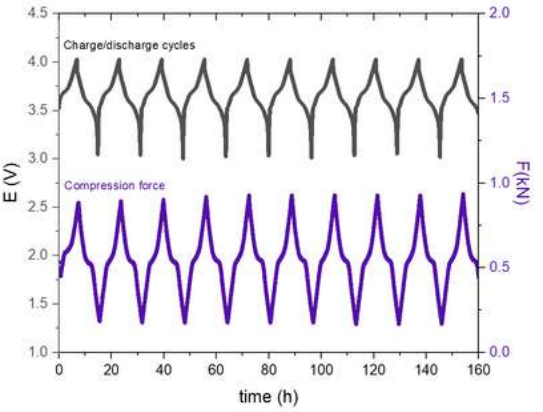


Fig. 1 - Setup assembled for tests under the "fixed thickness" protocol (left), where the plates are locked in place after applying the desired pressurizing force. Charge and discharge profiles, along with the force response to cell swelling, are shown on the right.

Pressure applied via a fixed force mode

In contrast, the "fixed force mode" is a testing protocol in which pressure is stabilized by incorporating springs into the testing setup. The springs act as a mechanical buffer, absorbing changes in thickness caused by cell swelling with minimal variation in applied pressure. This simple and affordable yet powerful feature enables pressure stabilization without the need for complex automated setups. Additionally, the use of springs allows for coupling the tests with in-operando thickness monitoring, providing valuable insights into battery cell behavior.

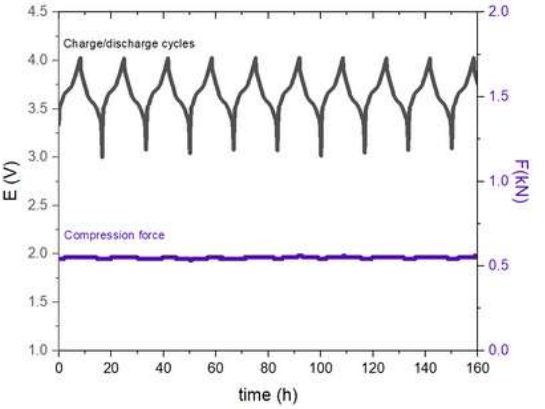
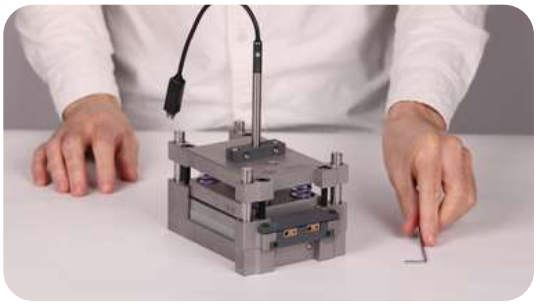


Fig. 2 - Setup assembled for tests under the "fixed force" protocol (left), with the jig equipped with pressurizing springs. Charge and discharge profiles, along with the stabilized force response that actively compensates for cell swelling, are shown on the right.

Multiple options of pressurizing springs

Pressure stabilization has a significant impact on electrochemical performance and battery pack design. The key factor behind pressure stabilization is the spring coefficient of the springs used in the setup. This critical parameter can be adjusted by selecting different springs from the wide range of spring coefficients offered by Sphere Energy.

Precise characterization of volume changes at the cell level



Battery performance is shaped by the electrochemical evolution with impact on cell geometry and mechanics — swelling, breathing, and structural changes that directly impact efficiency, safety, and lifespan. The ASC-P+ provides high-resolution, in-operando thickness monitoring to reveal how cells evolve under real-world conditions.

Tracking Long-Term Swelling Trends

Battery aging and capacity fade are often linked to structural transformations at the cell level. Battery cells gradually swell over time due to SEI formation, gas generation, metal plating and electrochemical grinding. ASC-P+ enables real-time tracking of cell thickness, helping researchers correlate swelling with electrochemical performance and develop strategies to mitigate long-term degradation.

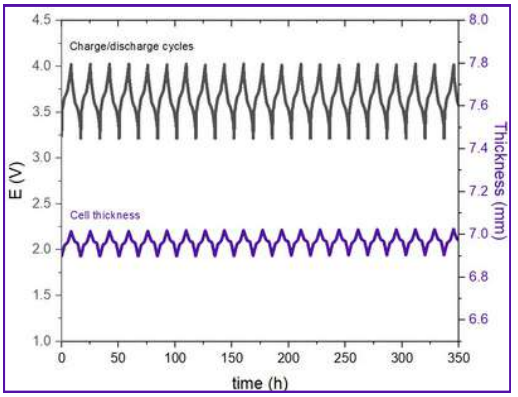


Fig. 3 - Cell thickness evolution during cycling under fixed force testing protocol.

Electrochemical Breathing: The Hidden Dynamics of Charge-Discharge Cycles

During cycling, cells undergo repeated expansion and contraction due to the reversible volume changes at the electrode level. This breathing effect plays a key role in mechanical fatigue and interfacial stability. By quantifying these subtle deformations in real time, ASC-P+ provides key insights for cell design, pressure management, and reliability improvements.

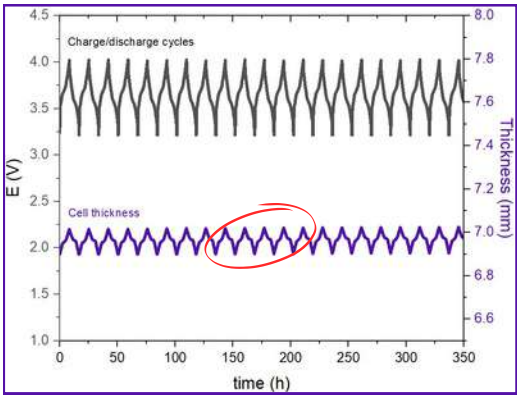


Fig. 4 - Voltage and cell thickness during cycling under fixed force testing protocol.

Sub-Micron Sensitivity for In-Operando Characterization

Mechanical changes at the micro-scale often dictate macroscopic battery behavior. The ASC-P+ detects thickness variations as small as 0.1 µm, revealing fine mechanical fluctuations often undetectable. This level of precision allows researchers to correlate mechanical responses with electrochemical performance, uncovering stability shifts and early signs of degradation.

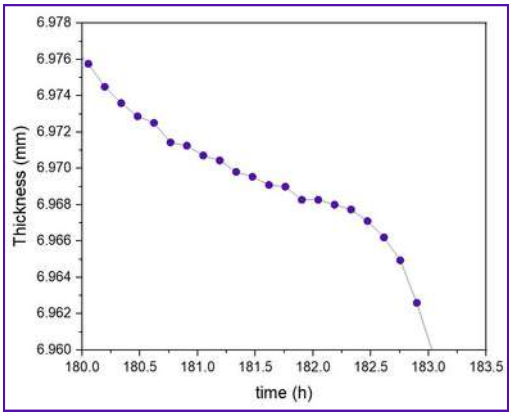
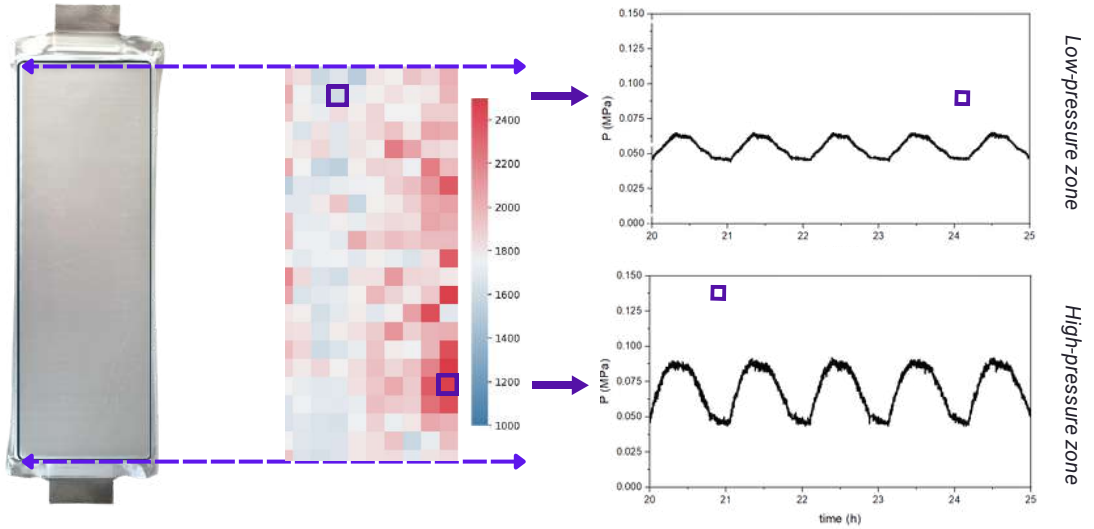


Fig. 5 - Zoom into the thickness data collected during cell testing showing the capability of the system to detect minimal changes in the cell volume.

Detecting homogeneity and evolution for improved cell performance and safety



Advanced characterization for pouch and prismatic cells

Understanding how pressure and temperature distribute across a battery cell is essential for optimizing performance, enhancing durability, and ensuring safety. Even small variations in mechanical or thermal conditions can influence ion transport, electrolyte behavior, and electrode stability, ultimately shaping a cell's efficiency and lifespan. By mapping these critical parameters, researchers can move beyond static testing and gain a real-time, spatially resolved view of how a cell responds under different conditions. The ASC-P+ can be equipped with up to **56 surface sensors** enabling a complete characterization of pressure and temperature distribution at the cell level.

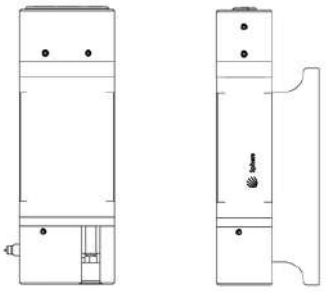
Attesting pressure distribution on ASC-P+

Not all cells distribute pressure evenly — cell geometry, electrode stacking, and internal structure all contribute to variations in mechanical stress. Ensuring that your test equipment is capable of providing homogenous pressure distribution is key for characterizing the performance of battery cells.
Here below you can find the pressure distribution of the ASC-P+ measured assessed via prescale pressure films (Fujifilm), revealing how force is applied across: i. metallic plates, ii. pressure pads and a iii. pouch cell samples.

Pressure distribution on bare metallic plates

Pressure distribution on ASC-P+ equipped with pressure pads

Pressure distribution on a pouch cell sample using pressure pads



Dimensions: 352 x 120 x 132 mm
Weight: 4 kg
Pressure ranges: 0-6 MPa
Temperature range: 0 to 80°C

The ASC-IP

Unlocking the Power of Uniform Pressure

In solid-state battery development, stack pressure is no longer just a boundary condition — it's a performance driver. The ASC-IP is Sphere's response to the growing recognition that pressure uniformity is critical not only during assembly but throughout the battery's life.

Based on isostatic compression, the ASC-IP allows researchers to test electrochemical systems under hydrostatic pressure, eliminating mechanical anisotropy and applying equal force from all directions. This shift from uniaxial to isotropic pressure offers unmatched homogeneous pressure distribution along the samples with impact on contact integrity, ion transport, and most interfacial behaviors.

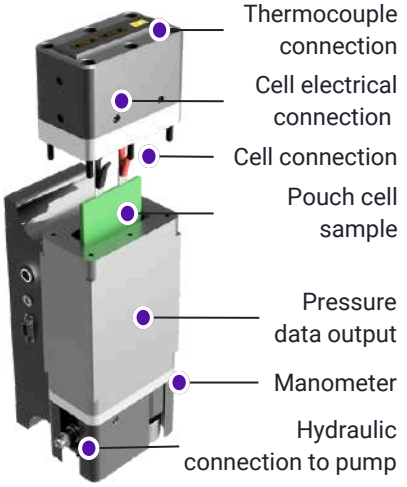
Designed as a new testing tool for advanced R&D on pouch cells, the ASC-IP accommodates multiple sample sizes and pressure regimes while fully integrating with electrochemical protocols. It enables precise investigation of stress-sensitive phenomena — often hidden in conventional setups. With ASC-IP, mechanical control becomes a tool for deeper insight, offering researchers the chance to test the performance of pouch cells under truly three-dimensional, dynamic mechanical fields.

MAIN FEATURES

- Pressure range up to 6 MPa
- Compatibility with multiple pouch cell sizes and tab geometries
- Max pouch cell dimension 108 x 75 x 10 mm
- Pressure monitoring system
- Direct data transfer to potentiostat or cycler
- Compact design

ASC-IP setup contains:

- 1x ASC-IP isostatic electrochemical test cell
- 1× Hydraulic pump for manual pressurization
- 1x Hydraulic pressure monitoring system with automatic data transfer to potentiostat or cycler
- 1× Pouch cell connectors
- 1x Thermocouple for sample temperature probing
- 1x Set of cables and connection leads
- 1× User guide with recommended testing protocols



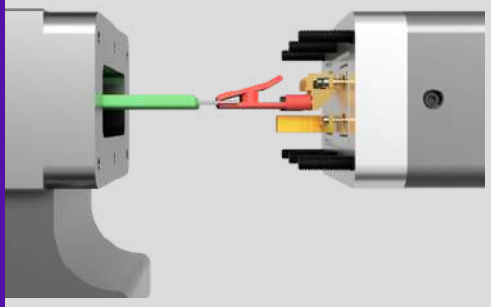
Compact design

Pressure monitoring and data transfer

Pressure control

Isostatic Pressure Control for Advanced Battery Testing

Pouch cell testing with flexibility



The ASC-IP setup accommodates multiple sample sizes and tab configurations thanks to its spacious internal cavity. Various cell designs can be easily integrated, with adjustable tab connectors either clamp- or screw-based that can be repositioned within the setup.

Electrical contact points are accessible from the front panel, alongside a dedicated connection for the thermocouple used to monitor sample temperature during testing.

Limitless connectivity

The ASC-IP is equipped with a built-in pressure monitoring system that continuously tracks the hydraulic pressure during testing.

This system can be directly connected to a cycler or potentiostat, allowing seamless synchronization between mechanical and electrochemical data.

Pressure control and visualization

The ASC-IP is also equipped with a pressurizing system capable of reaching a maximum pressure of 6 MPa (60 bar).

A manual hydraulic system, supplied with the setup, is used for pumping the hydraulic fluid and controlling the pressure applied. The pressure can be visualized via a manometer installed in the setup, and also monitored via the buitl-in pressure monitoring system.

ADD-ONS & ACCESSORIES

Precision Control for Pressure and Temperature

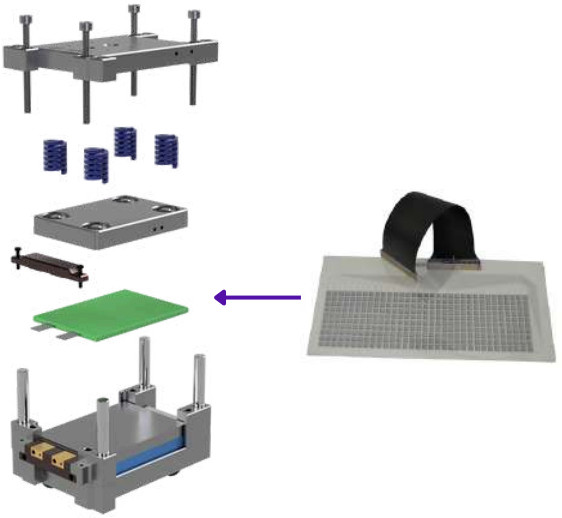
MAX FLEXIBILITY THROUGH THE ASC PRESSURE FRAME

In solid-state battery R&D, precise control over a wide range of parameters is critical for consistent innovation. Recognizing the importance of accurate pressure management, our test cells are designed for seamless integration with our mechanical press, the pressure frame. This tool is capable of delivering and monitoring up to 20 kN of force, all within a compact design that easily fits inside the small antechamber of a glove box.

Compactability of ASC Pressure frame wihh the main cells

The pressure frame plays a crucial role in enhancing the flexibility of our ASC setups. It smoothly integrates all the different variations of cell tests under the same pressure monitoring platform, allowing standard and accurate measurements of pressure under different tests applications.

ASC-P – PRESSURE AND TEMPERATURE MAPPING SETUP



- Mapping sensors directly in contact with the cell body
- 56 detection points

Advanced characterization for pouch and prismatic cells

The distribution of pressure and temperature in pouch and prismatic cells significantly affects their performance and longevity. Characterizing these parameters is crucial for optimizing the operating conditions of battery cells. This optimization leads to higher energy storage capacities, better swelling management, and ensures that the cells operate safely.

Our ASC-P and ASC-P+ setups, designed for pouch and prismatic cell testing, can be equipped with pressure and temperature mapping systems. These mapping systems utilize flexible circuits that can accommodate a large number of sensors to monitor pressure and temperature distribution during battery cell testing. Developed in collaboration with Flexoo (Germany), the mapping systems consist of thin pads that are incorporated into Sphere's testing jigs, ensuring direct contact with the surface of the cells.

Pressure: 1kPa to 5 MPa / 20° to 100°C
Temperature: <1°C accuracy on T meas. / <3% accuracy on P meas.

A complete turnkey solution for advanced insights

The pressure and temperature mapping setup provides a comprehensive solution for assessing the uniformity of pouch and prismatic cells. Signals collected from multiple sensors are processed using specialized hardware and software, enabling the measurement of up to three sensor maps simultaneously.

PRESSURE MONITORING AND TEMPERATURE CONTROL

The control box plays a vital role in powering and processing all the information collected from the pressure and temperature sensors. It displays the value of the pressure applied to the the sample in real-time. The data can be transmitted to external devices via an analog output, ensuring full synchronization of pressure information with the electrochemical data from a potentiostat/cycler. This integration is important for achieving optimal performance and accuracy. The control box is also tasked with monitoring and regulating the temperature of the ASC-T+ setup, which is crucial for exploring advanced tests in the field of solid-state batteries.

Two different options of control boxes are available depending on your application:

ASC CONTROL BOX with pressure frame and ASC-T+ cell

1

1. ASC CONTROL BOX FOR TEMPERATURE

This control box is designed to monitor the mechanical pressure applied to the samples inside the different cells and to control the ASC-T+ temperature. It includes an analogical output for external communication of mechanical pressure values.

PROGRAMMABLE PID OPTION

The ASC CONTROL BOX can also be equipped with a programmable PID that receives temperature control protocols directly from a computer connection.

ASC CONTROL BOX FOR PRESSURE with pressure frame and ASC-T+ cell

2

2. ASC CONTROL BOX FOR PRESSURE

This simplified control box is designed solely for monitoring the mechanical pressure applied to samples within various cell types. It features an analog output for the external communication of mechanical pressure values.

THICKNESS MONITORING SOLUTIONS

Sample thickness plays a critical role in the research and development of solid-state batteries, particularly when studying solid-state electrolytes or swelling phenomena. Our options for thickness measurement provide a range of solutions that enable you to precisely assess this parameter. You can measure sample thickness in-situ and in-operando within most ASC cells using our pressure frame.

1

1. IN-OPERANDO THICKNESS MONITORING SYSTEM

The thickness measurement relies on a displacement sensor attached to the pressure frame through an articulated arm. This setup is designed for in-operando thickness measurements, featuring data display and automated data recording via software or analogical output. It offers a precision of 1 µm and 0.1 µm of resolution.

2

2.IN-SITU THICKNESS MONITORING SYSTEM

The thickness measurement is based on a micrometer attached to the pressure frame through an articulated arm. This setup is specifically designed for in-situ thickness measurements, with a data display integrated into the probe. It achieves a precision of 3 µm and a resolution of 1 µm.

3

3. WIRELESS CONNECTION FOR THICKNESS OPTION

Wireless connection between micrometer and computer for punctual data recording. Each time the triggering button is pressed, a data point is sent directly to an Excel table. The product package includes a transmitter, receiver, and necessary cables.

ASC PACKAGE

ADVANCED ELECTROCHEMICAL TESTS WITH HIGH-THROUGHPUT

Screeing tests / Long term testing / Advanced tests and hight temperature / Fixed thickness / fixed pressure / Airtightness / High pressure / Pressure monitoring

The ASC Package is an essential toolkit for conducting comprehensive research related to solid-state batteries. It comprises the ASC-T+, designed for temperature- and pressure-controlled electrochemical tests; the ASC-X, a next-generation airtight cell offering precise pressure control up to 400 MPa with interchangeable pistons (8, 10, and 12 mm); and the ASC-AD, utilized for dynamic pressure control. Moreover, it is equipped with a mechanical press (pressure frame), a control box (control unit), a calibrated torque wrench, and all the necessary accessories required for smooth handling. With the ability to run three electrochemical cells in parallel, it enables detailed analysis of battery materials while ensuring optimal throughput.

ASC PACKAGE contains:

1x ASC-T+ electrochemical test cell with temperature control and pressure monitoring
1x ASC-X airtight electrochemical test cell
1x ASC-AD airtight electrochemical test cell with dynamic pressure control system
1x Pressure frame (mechanical press)
1x ASC control box (control unit)
1x Calibrated torque wrench
1x Glove box feedthrough adaptor, set cables and connection leads
1x Set of tools, cables and accessories

ASC+ PACKAGE

ADVANCED ELECTROCHEMICAL TESTS WITHIN LARGE PRESSURE RANGES

Advanced tests and hight temperature / Low pressure range / Fixed thickness / Fixed pressure / High & low pressure / Pressure monitoring / Swelling monitoring (Optional)

The ASC+ package represents the pinnacle of our testing solutions, amalgamating the most sophisticated setups in our portfolio: the ASC-T+ and ASC-AD+. This package is best suited for deep analysis of key parameters of solid-state battery R&D. The ASC-T+ is specifically designed to conduct temperature-controlled tests and can achieve a maximum temperature of 200°C and 400 MPa pressure. Conversely, the ASC-AD+ is optimized for low-pressure tests in an airtight environment. Both setups provide real-time pressure monitoring data and facilitate test upscaling with multiple sample sizes.

ASC-T+ setup contains:

1x ASC-T+ test cell equipped with built-in temperature control system
1x Set of pistons and internal sleeves for multiple sample diameters (8, 10, 12 and 14.5mm)
1x Ceramic sleeve for samples of 8 mm of diameter
1x Internal sleeve with reference-electrode based on Cu
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Pressure frame equipped with a pressure sensor for material pressing and pressure monitoring
1x Control unit equipped with a temperature control system, pressure display and analogical output for pressure data transmission to potentiostat, cycler or computer
1x Glove box feedthrough adaptor, set of cables and connection leads*

ASC-AD+ setup contains:

1x ASC-AD+ electrochemical test cell
1x Control unit equipped with pressure display and analogical output for pressure data transmission to potentiostat, cycler or computer
1x Set of pistons and internal sleeves for multiple sample diameters (8, 10, 12 and 14.5mm)
1x Glove box feedthrough adaptor
1x Sample removing tool
1x Holder for weighing and loading materials in the cell
1x Set of loading tools and adaptors for sample preparation
1x Set of tools, springs, sealing o-rings and cables

ASC-X PACKAGE

PRESSURE MONITORED SOLID-STATE BATTERY TESTS

Screeing tests / Fixed thickness / Airtight / High Pressure / Swelling monitoring (Optional)

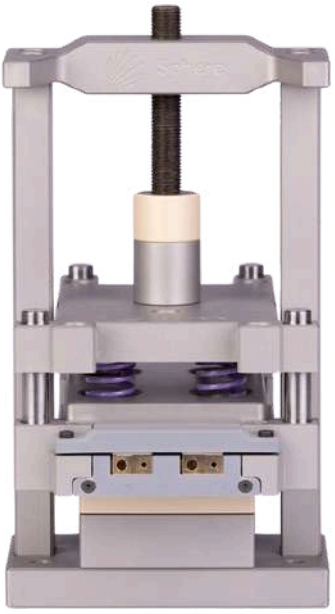
The ASC-X package is specifically designed for testing air-sensitive materials outside the glovebox, combining mechanical compression with precise, reproducible pressure control in an airtight environment. This package includes the ASC-X electrochemical test cell—featuring interchangeable pistons (8, 10, and 12 mm), enhanced sealing architecture, and compatibility with add-ons like pressure and swelling monitoring—a pressure frame, and a control box. It offers a robust and flexible solution for advanced solid-state battery research, whether working with limited sample quantities or exploring larger interfaces.

ASC-X PACKAGE contains:

1x ASC-X airtight electrochemical test cell
1x Pressure frame (mechanical press)
1x ASC control box (control box for pressure)
1x Calibrated torque wrench
1x Glove box feedthrough adaptor, set cables and connection leads
1x Set of tools, cables and accessories

ASC-P PACKAGE

ADVANCED TESTS ON POUCH CELL BATTERIES



Pouch format / Fixed thickness / Fixed pressure or hybrid / Swelling monitoring (Optional) / Pressure mapping (Optional) / Temperature mapping (Optional)

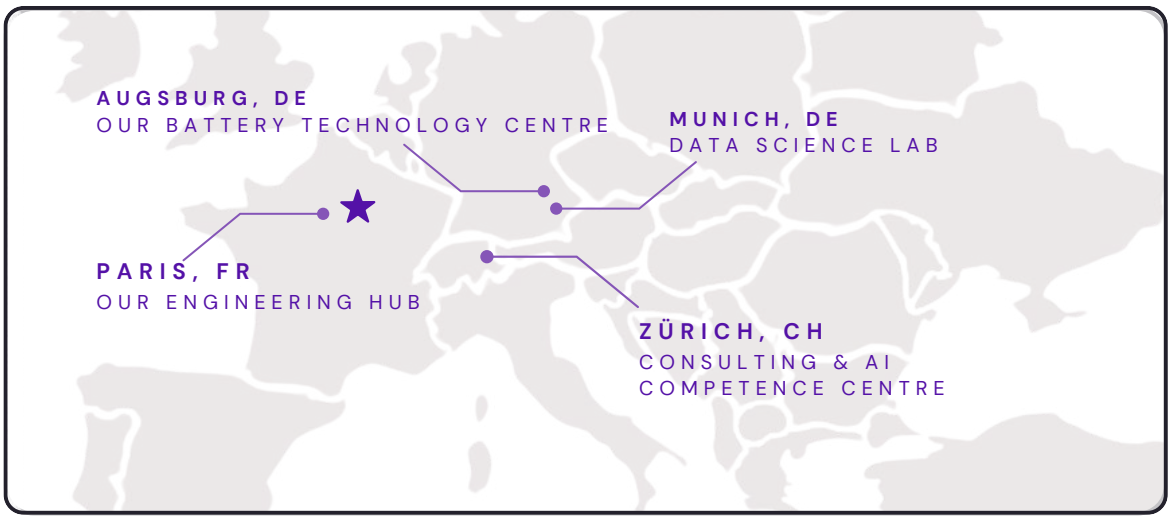
The ASC-P package offers essential tools for battery researchers focused on prototyping. The ASC-P enables precise control over mechanical stress simulations and pressure adjustments, critical for investigating battery durability and optimizing performance under varying conditions. With its dual operational modes (fixed thickness / fixed pressure), it adapts to different experimental needs. The integration with the Pressure Frame and ASC Control Box facilitates consistent pressure monitoring and enhanced data reliability. This comprehensive approach supports researchers in advancing battery technology through rigorous, accurate tests under controlled key parameters.

ASC-P PACKAGE contains:

1x ASC-P testing setup
1x Pressure frame (mechanical press)
1x ASC control box (control box for pressure)
1x Torque wrench for manual pressure application
1x Glove box feedthrough adaptor, set cables and connection leads
1x Set of medium-force springs (spring rate 216N/mm)
1x Set of low-force springs (spring rate 98N/mm)
1x Set of extra low-force springs (spring rate 32N/mm)
1x Set of tools, cables and accessories

ABOUT

SPHERE ENERGY



The world is shifting towards sustainable energy solutions with a strong focus on reducing CO2 emissions. At the core of this revolution is global R&D, crucial for discovering new materials and technologies. However, a significant challenge remains: the lack of specialized testing equipment and advanced data solutions, hindering the exploration of materials that require novel testing methods and deeper data analysis.

Sphere Energy addresses this challenge by providing testing solutions and cutting-edge data analytics. As a team of battery experts, we support the entire battery value chain, from cell manufacturers to OEMs, offering **state-of-the-art hardware**, **customized battery testing**, and **AI-driven insights**. Our Battery Technology Centre serves as the hub for testing and validating advanced battery technologies, integrating AI and data analytics to enable unmatched innovation and optimization in the pursuit of sustainable, next-generation energy solutions.

Our products can be fast delivered worldwide when in stock. If not immediately available, we commit to delivering within 30 to 45 days.

Guaranteed responses within 24 hours, ensuring your queries are addressed promptly and efficiently.

All products are backed by an official 24-month warranty.

Our products are crafted with the highest standards of quality, durability and performance.

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