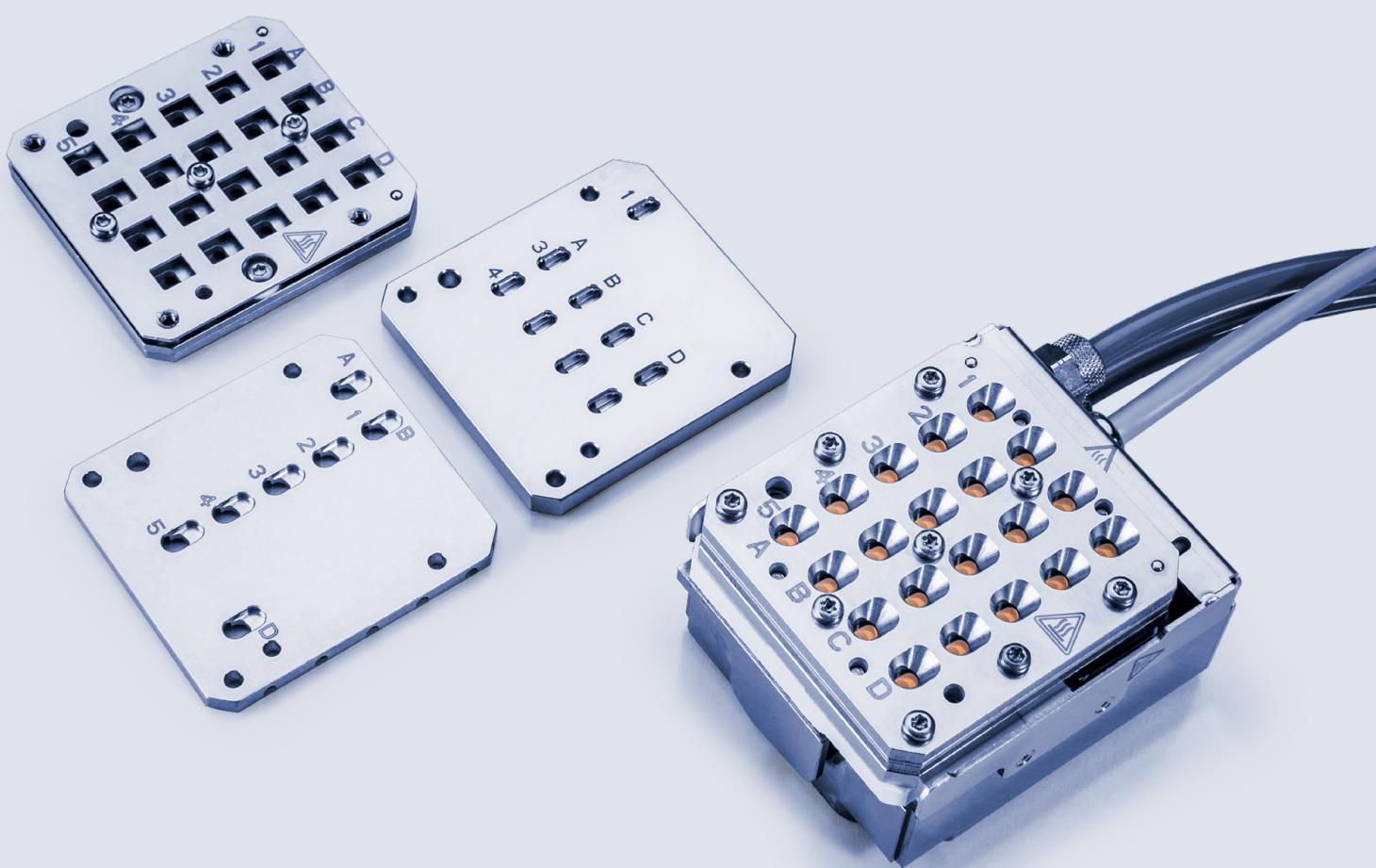


# Pure Brilliance: For All Applications

SAXS Sample Stages and Holders



# The Right Solution for Every Experiment

Anton Paar offers a wide range of off-the-shelf high-quality, high-precision sample stages and holders for its SAXSpoint 700 and SAXSpoint 500 SAXS/WAXS systems. Whatever your application needs, these sample stages and holders empower you with the utmost flexibility to characterize your nanostructured material under ambient and non-ambient conditions.

Precise control of temperature, atmosphere, and pressure

Accurate sample positioning – of special importance for sample mapping and GISAXS studies

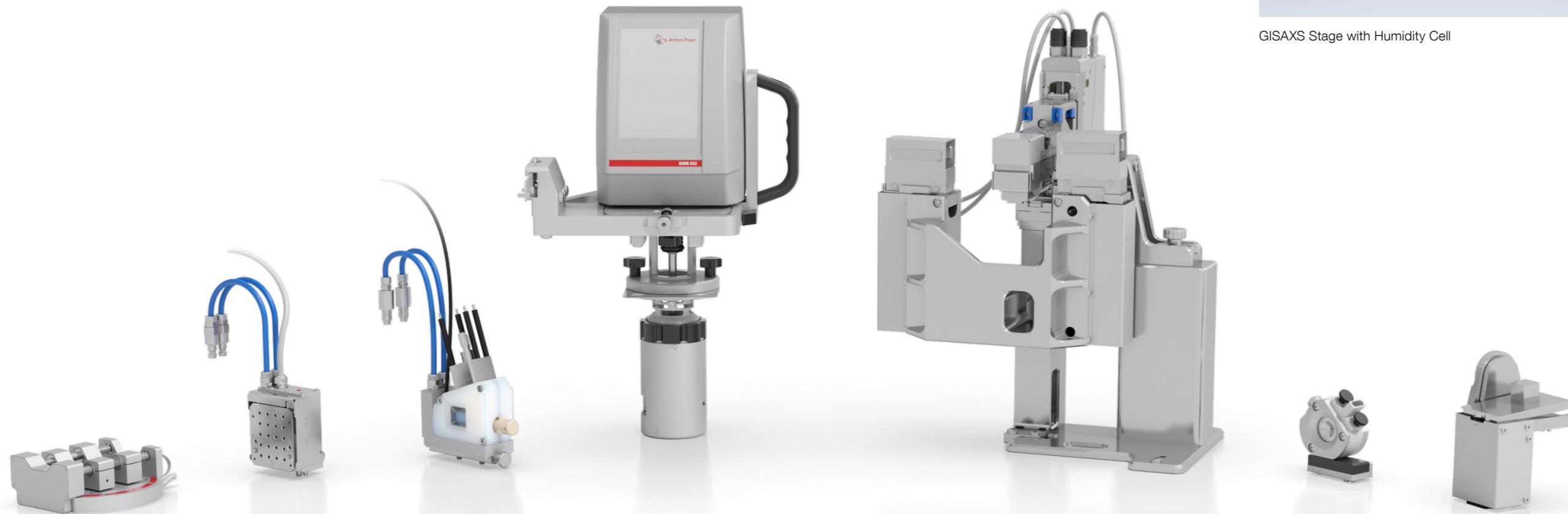
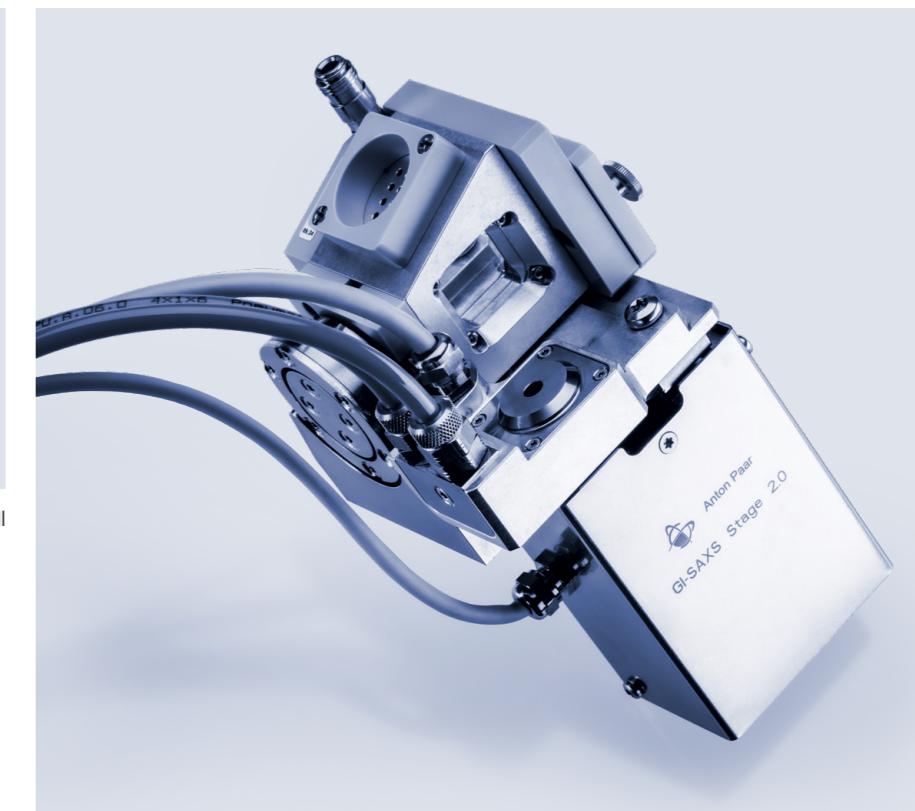
Full integration into the SAXS software and hardware – providing automatic recognition and configuration, self-alignment, and automatic q-range optimization



Find out more

# Choose Your Stages

**High-quality, high-precision off-the-shelf sample stages and holders for almost every type of sample material. All stages are fully integrated in the software and hardware, automatically recognized, and configured for the setup.**



## TS 600 Tensile Stage

Stress/strain investigations

## Temperature-controlled autosamplers for multiple samples

Automated sampling/ mapping of multiple samples

## Humidity Stage

Experiments at different humidity levels in both transmission and reflection geometry (GISAXS)

## RheoSAXS

Combined rheology and scattering experiments on liquids

## USAXS Stage

Automatic USAXS, SAXS, and WAXS studies

## Battery Cell

Electrochemical/battery cell for operando scattering studies of energy storage or conversion materials

## GISAXS Stage

Grazing-incidence, small- and wide-angle X-ray scattering (GISAXS/GIWAXS) studies

## Customized and high-throughput solutions

Method combinations and customized solutions such as the UV/Vis-SAXS cell, as well as the autosampler for high-throughput applications

# Temperature- Controlled Stages and Holders

**Fully automated measurements of up to 20 samples in a single run.**

Temperature-dependent investigations are a core part of SAXS/WAXS measurements for characterizing material properties. Anton Paar's temperature-controlled samplers bring multiple samples into the X-ray beam across a wide temperature range from -150 °C to +350 °C. The sample holder mounts quickly and easily to the sample stage, ensuring a fast and straightforward setup.

Experiment planning is simple and efficient using SAXSpoint control software. Measurement order, temperature profiles, and sample-to-detector distances (SDD) can be predefined for each sample, allowing complex experimental sequences to run automatically with minimal user intervention.

For even greater experimental flexibility, the Heated Sampler can be combined with a Cryo Module, extending the temperature range down to -150 °C and enabling reliable cryogenic measurements.

## Benefits:

- Wide temperature range: -150 °C to +350 °C
- Diverse sample holders to analyze multiple solids, foils, films, powders, gels, pastes, and liquids
- High degree of temperature accuracy
- Quick heating/cooling rates
- Maximum heating homogeneity at all sample positions
- Automated multiple sample measurement of up to 20 samples
- Plug-and-play feature for simple installation and automated recognition with SAXSpoint 700 and 500

**Heated Sampler:  
ambient to +350 °C**

**Heated/Cooled  
Sampler: -10 °C to  
+120 °C**

**Cryo Module for  
Heated Sampler:  
-150 °C to +350 °C**

## Liquids

- Multi-cuvette holder: Allows the loading of up to five single sample holders, and the optional use of the quartz capillary,  $\mu$ Cell, PasteCell N, FlowCell, TubeCell, and sample holder for solids. Provides maximum flexibility to insert different single sample holders in the same multi-cuvette holder.
- Holder for disposable capillaries: Enables the loading of up to five disposable capillaries. Separate holders are available for horizontal or vertical positioning of disposable capillaries.

## Pastes/gels

- PasteCell HS: Capable of loading of up to four samples

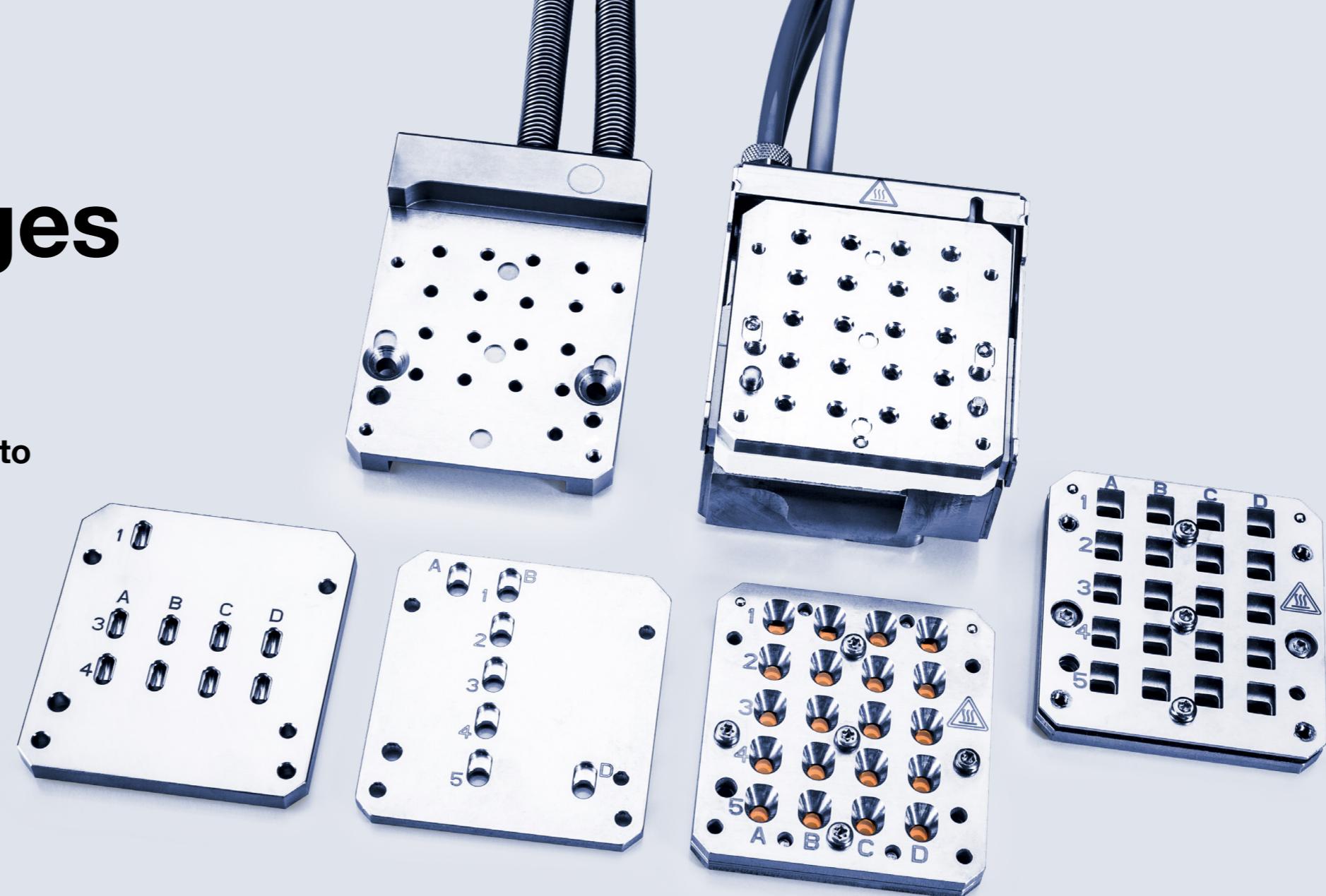
**Sample holders for multiple samples**

## Solids

- Multiple solid sample holder: Provides space to load up to 20 samples

## Special sample holders

- SiN Cell: Unique low-parasitic flow-through cell for measurement of liquids supporting a temperature range of -10 °C to +120 °C. An extremely low scattering background is beneficial for weakly scattering samples.
- On request, Anton Paar supports you in designing and manufacturing customized multiple sample holders, e.g., with a different number of sample positions.

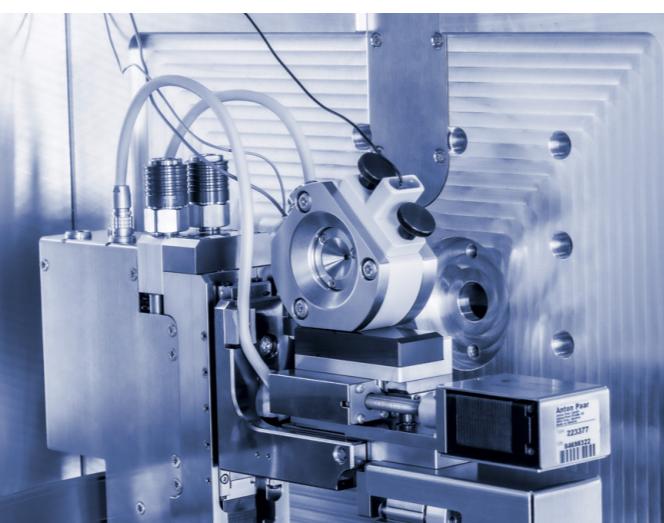


# Dedicated Sample Stages

**GISAXS Stage**



**Battery Cell**



## Grazing-incidence small-angle X-ray scattering (GISAXS)

Obtain maximum information from your sample with dedicated sample stages for special investigations. Use insights into the surface nanostructure of thin-film samples.

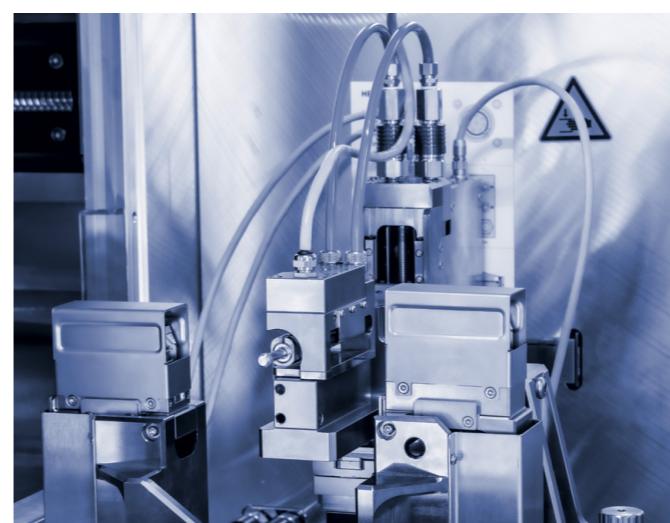
Grazing-incidence small-angle X-ray scattering (GISAXS) applications include the characterization of mesoporous thin films, surface-deposited nanoparticles, metal deposits on oxide surfaces, and soft matter systems such as polymer/block copolymer thin films and biological materials attached to surfaces.

Anton Paar's GISAXS Stage is a high-resolution, high-precision motorized sample stage for performing grazing-incidence SAXS/WAXS/diffraction (GISAXS/GIWAXS/GIXD) studies of thin-film samples.

It is equipped with a  $\Phi$ -rotation module allowing sample rotation from 0° to 345°. The samples can be tilted across an angular range of -4° to +5.6° to vary the penetration depth of the incident beam. The stage can be equipped with the GISAXS Heating Module to perform temperature-dependent studies up to 500 °C or with the Heated/Cryo Module for covering a temperature range from -150 °C to +350 °C.

**Get the best out of the experiment with your sample thanks to dedicated sample stages for special investigations.**

**USAXS Stage**



**Other Stages**



## Operando battery measurements

Simultaneous investigations of electrochemical performance and nanostructural evolution.

The electrochemical scattering cell allows investigation of, e.g., Li-ion, Li-S, Li-air, Na-I, super capacitor materials, electrodeposition/dissolution processes, corrosion processes, and electrocatalysis.

Anton Paar's Battery Cell for SAXS permits simultaneous investigations of electrochemical performance and nanostructural evolution – including changes in size, shape, and morphology – under real operating conditions.

The in situ cell is mounted on an adjustable sample stage base and enables precise alignment of the cell in the X-ray beam. The cell design ensures a sealed environment for the electrochemical cell materials, good electrical contact for all electrodes, and sufficient penetration of X-rays in transmission. The feed-through adapter includes plugs for connecting an external potentiostat or galvanostat for cycling. And the cell inside can be connected to different gases (e.g., O<sub>2</sub> for Li-O<sub>2</sub> batteries).

## Automatic USAXS, SAXS, WAXS studies

Characterize materials from the nanometer to the micrometer level.

USAXS is used to characterize large-scale structures and hierarchical morphologies in porous materials, polymers, colloids, metals, and soft matter systems.

The USAXS Stage enables automatic, sequential acquisition of X-ray scattering data, providing high-quality USAXS, SAXS, and WAXS information in a single measurement. With its advanced design, it resolves structural details across a wide range – from Ångstroms to over 2.5 micrometers. The fully motorized setup empowers users to obtain high-quality data from their samples via automated, sequential X-ray scattering measurements, involving no manual interaction or change of the measurement configuration.

## Customized solutions

Anton Paar's longstanding experience in the design and production of sample environments empowers it to provide expert support for the implementation of customized specific requirements as well as for integration and combination with other instruments.

## Rotation Module

Fibers and films often require special measuring equipment to obtain a full picture of the sample from all angles. The Rotation Module enables measurement during rotation of the sample perpendicular to the X-ray beam at ambient temperatures for isotropic and anisotropic fiber and film studies.

## Tensile Stage

The Tensile Stage allows for tensile studies combined with SAXS/WAXS investigations. Typical samples for tensile measurements are fibers, foils, and thin films for use in special tissues, clothes, covers, and composite materials.

This stage is used in transmission geometry and allows you to subject samples to strain with a force of up to 600 N.

# Stages Combining Complementary Techniques

Combine complementary techniques in one setup: full rheological characterization during SAXS investigations as well as humidity studies to optimize your material for its intended use.

RheoSAXS Module



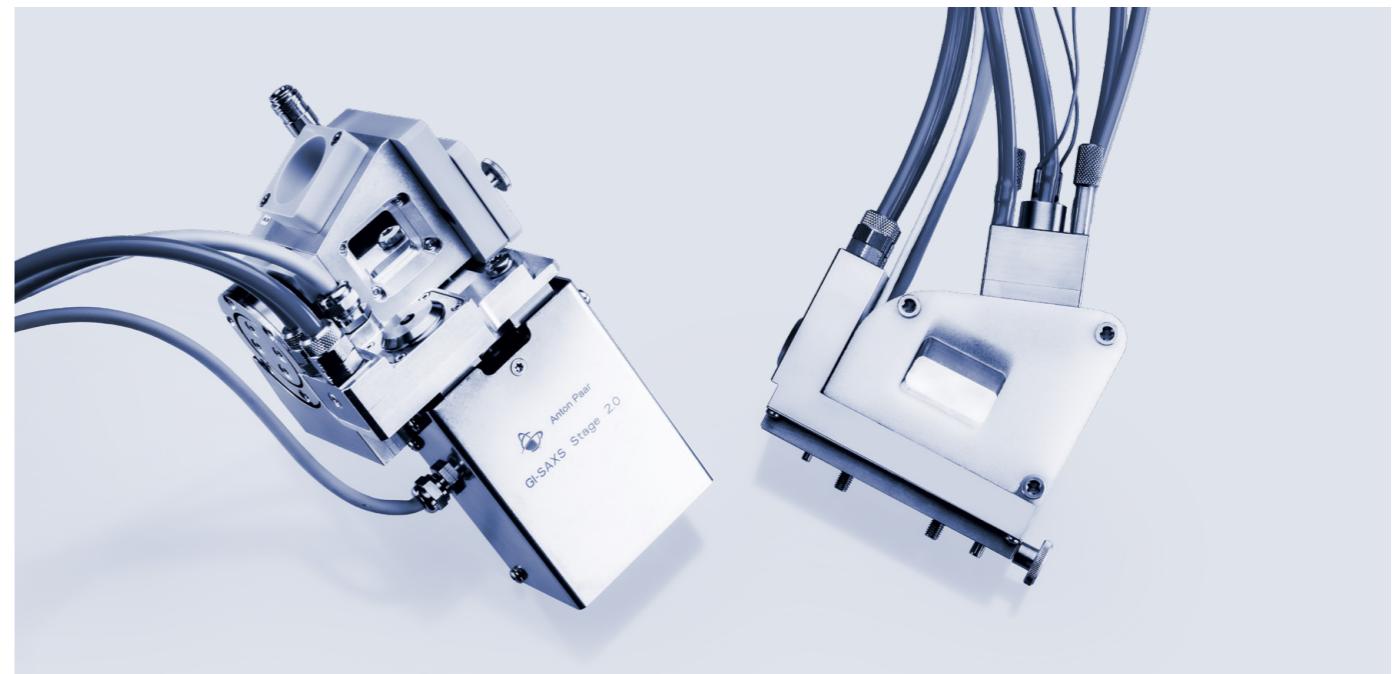
## A unique combination of rheology and SAXS in one lab-scale instrument

RheoSAXS uniquely positions users to directly correlate structural changes recorded on the nanometer scale with macroscopic properties determined in rheological investigations. This method combination is of particular advantage in the investigation of modern smart materials exhibiting uncommon properties. Typical application fields are cosmetics, colloidal dispersions, polymers, nanomaterials, and nanomicromaterials.

The RheoSAXS Module comprises the DSR 502 dynamic shear rheometer measuring head and a dedicated cylindrical RheoSAXS measuring cell for axial and tangential measurement mounted into the measuring chamber of SAXSpoint 700.

The RheoSAXS measuring cell is temperature-controlled across a range from -10 °C to +90 °C. The fully integrated DSR 502 measuring head offers all standard measuring capabilities, e.g., rotational and oscillatory measurement modes. You further benefit from accurate measurements of even low-viscosity dilute suspensions with a minimum torque of 10 nNm (in rotation) or 2 nNm (in oscillation).

Humidity Cell



## Humidity and nanostructure investigations

Investigations into structural changes under the influence of humidity are important for determining, e.g., a sample's stability during storage and transport or under the conditions for its intended use and over its life cycle. Degeneration of materials and the exchange of the affected materials are often costly, so thorough investigations under controlled conditions are important.

Anton Paar's dedicated Humidity Stage allows temperature- and humidity-dependent studies of transmission and reflection geometries (GISAXS). Designed for powders and solids (films, fibers) it enables measurements under humid conditions from 5 % to 95 % relative humidity (RH) at temperatures ranging from 10 °C to 60 °C and under vacuum, air, or inert gas across a temperature range from 10 °C to 110 °C.

The Humidity Stage is operated with the Modular Humidity Generator which precisely controls the relative humidity. Highly exact temperature and humidity sensors close to the sample guarantee uniform and well-defined humidity conditions and maximum thermal homogeneity. The sophisticated design ensures maximum interaction of sample and humid atmosphere.

# World of SAXS Applications

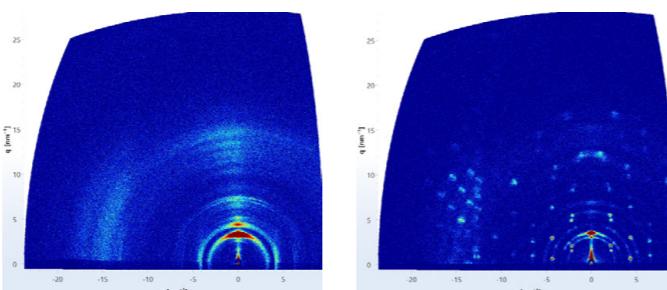
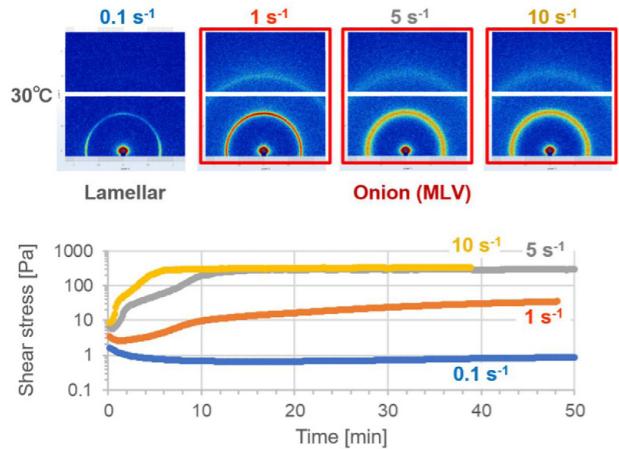
Our SAXS stages enable material research for key technologies at the nanometer scale under dedicated conditions.

## RheoSAXS

Correlating flow behavior and structure: Non-ionic surfactants have excellent properties for health and personal care products, with their flow behavior and structure influencing the properties of the final products. Combined studies with the unique RheoSAXS module for SAXSpoint reveal the formation of an onion-like structure of a polyoxyethylene alkyl ether surfactant at a higher shear rate and elevated temperature. Through these, valuable information on the bilayer structure and flexibility are obtained.

## GISAXS Stage

The GISAXS Stage with heated/cryo attachment enables precise *in situ* studies of temperature-dependent structural changes in thin films. Ideal for organic electronics, it reveals subtle orientation transitions upon annealing. 2D GISAXS patterns before and after the annealing step (105 °C) demonstrate molecular reordering, providing key insight into performance-related morphology evolution.



Shear rate [s⁻¹]	No. of bilayers	d-spacing [nm]	Caillé parameter
0.1	18.6	8.43	0.271
1	19.4	8.34	0.230
5	7.75	8.12	0.231
10	7.76	8.07	0.246

# High-Throughput Autosampler

Measure up to 192 liquid samples fully automatically in a single run.

## ASX autosampler for liquids

Measure up to 192 liquid samples in one run with the ASX autosampler at ambient conditions. With the ASX-c version you can store samples at temperatures down to 4 °C while they await measurement. This is especially important for temperature-sensitive samples in order to protect them from denaturation and evaporation, ensuring consistent and reliable results.

The autosampler is fully integrated into the SAXS systems' hardware and software, making it very user-friendly. Different washing cycles can be programmed to avoid any contamination of samples during measurement. The autosampler is designed for minimum sample volumes down to 10 µL.

The ASX autosampler is used in combination with Anton Paar's flow-through cells such as the FlowCell, TubeCell, or SiN Cell.



# Available Sample Holders



Liquids

Solids and viscous samples

Special sample holders

## Quartz Capillary

- Standard capillary for liquid samples
- 5 °C to 90 °C

## µCell

- Low-volume capillary for precious liquid samples
- Minimum sample volume: 8 µL
- 5 °C to 90 °C

## FlowCell

- High-throughput measurements
- Low-noise 1 mm quartz capillary
- Automation with an autosampler unit
- 5 °C to 90 °C

## TubeCell

- Polymer flow-through cell
- High chemical and thermal stability
- For highly contaminating, non-cleanable, or non-removable samples
- Automation with an autosampler unit
- -30 °C to +150 °C

## TCS Sample Holder for Solids

- -150 °C to +600 °C

## PasteCell N

- For pastes, gels, and powders
- Sample is placed between exchangeable windows (Kapton or other materials)
- -150 °C to +300 °C

## High-Pressure Cell

- For studies under pressures up to 100 bar
- Gases that can be used: air, inert gas, CO<sub>2</sub>, methane, other non-explosive gases
- 0 °C to 90 °C (100 bar, up to 60 °C)

## TCS Capillary Holder

- Holder for disposable capillaries
- Temperature range depends on the disposable capillary used

## Sample stages

### Temperature-controlled stages for multiple samples<sup>1)</sup>

	SAXSpoint 500	SAXSpoint 700
Heated Sampler	✓	✓
Heated/Cooled Sampler	✓	✓
GISAXS Stage	✓	✓
Battery Cell	✓	✓
USAXS Stage		✓
Tensile Stage		✓
Rotation Module	✓	✓
RheoSAXS		✓
Humidity Cell	✓	✓
ASX autosampler for liquids	✓	✓

## Dedicated sample stages

## Method combinations with SAXS

## High-throughput autosampler

Trademarks: SAXSpoint (014036024)

1) Available sample holders: Multi-cuvette holder, PasteCell HS, SIN Cell, holder for disposable capillaries, multiple-solid-sample holder

**Reliable.  
Compliant.  
Qualified.**

Our well-trained and certified technicians are ready to keep your instrument running smoothly.



Anton  
Paar

