



HIGH-PRECISION GAS AND VAPOR ADSORPTION ANALYZER

BELSORP MAX X SERIES

microtrac.com/ru/products/gas-adsorption-measurement/surface-area-pore-size-distribution/belsorp-max-x/

BELSORP MAX X SERIES

HIGH-PRECISION GAS AND VAPOR ADSORPTION ANALYZER

A lot of Science in a little space: BELSORP MAX X. High-End Adsorption. Smallest Footprint. Unrivalled Performance.

Microtrac's BELSORP MAX X is the latest model in the BELSORP MAX series, featuring a more compact design and lower weight. This high-precision gas / vapor adsorption analyzer can measure up to four samples over a wide range of pressures and temperatures. BELSORP MAX X covers a broad array of analysis capabilities from specific surface area, pore size distribution, gas, and vapor adsorption to chemisorption.

Combining high-precision pressure transducers (133.3 kPa, 1.333 kPa, and 0.0133 kPa) with hard-sealing pneumatic valves and metal gaskets, the analyzer has superior technology to minimize gas leakage and enable ultimate vacuum levels. Temperature in the BELSORP MAX X is carefully controlled using state-of-the-art technology, from the heated manifold block (50 °C, optional 80 °C) and air bath to the sample, while electropolished gas / vapor lines prevent surface wetting and corrosion.

Additionally, the new BELCONTROL operation software facilitates understanding of the structure and durability of materials through cyclical stability analysis, improves measurement and maintenance efficiency, and sends measurement results via e-mail – all resulting in maxImized sample throughput. BELMASTER is the dedicated analysis software for advanced material evaluations. This instrument complies with ISO 9277, 15901-2 and 18852 and can be used for various material morphologies, such as molded bodies, pellets, and fine powders.



STATE-OF-THE-ART TECHNOLOGY IN THE SMALLEST SPACE

MAXIMIZE YOUR LAB SPACE

Maximize your lab space by minimizing the footprint! The required lab space is reduced by almost **50%** compared to alternative products.



GAS ADSORPTION / BELSORP MAX X

EASY DATA MANAGEMENT & MORE QUALITY INSIGHTS

MAXIMIZE YOUR ACCURACY

AFSM™: HIGHEST REPRODUCIBILITY AVAILABLE ON ANY ADSORPTION INSTRUMENT

Rather than attempting to control the approximate level of liquid coolant, our innovative method of continuously monitoring free space variations in a reference cell – Advanced Free Space Measurement (AFSM™) – has been proven to provide greater measurement accuracy. It accurately compensates for free space fluctuations due to environmental factors such as:

- Changes in LN₂ level
- Changes in temperature and pressure in the atmosphere
- Changes in coolant temperature due to dissolution of oxygen

VAPOR ADSORPTION OPTION

Inside the BELSORP MAX X, all gas lines, gauges, etc. are installed in a thermostatic air chamber (50 °C) covered with thermally insulating material. The fully temperature-controlled instrument prevents vapor condensation effects and allows various vapor adsorption measurements to be made. It includes measurements with organic vapors up to 40 °C (standard instrument; HT model up to 70 °C). The evaluation of hydrophilicity / hydrophobicity and the measurement of VOC adsorption capacity are further application possibilities.

FULLY CUSTOMIZABLE & UPGRADEABLE

MAXIMIZE YOUR FLEXIBILITY



EXTENSIVE PRODUCT RANGE

BELSORP MAX X is available in different models for a wide range of applications. Microtrac offers the perfect solution for each customer's individual needs.



GAS SELECTOR FOR DIFFERENT ADSORBENTS

Three gas ports (corrosion resistant) are available in the standard configuration. To expand one standard line to four gas lines, a gas selector can be added. The gas lines can be expanded from 3 to 6, 9 and 12 lines.



MEASUREMENT TEMPERATURE CONTROL

Доступны криогенные сосуды (жидкий криогенный газ), водяные бани (-10°C до 80°C) и нагреватели (50°C до 550°C), что охватывает широкий диапазон измерительных температур. Нагреватель можно использовать как для измерений, так и для подготовки образцов.

НЕОБЯЗАТЕЛЬНЫЙ КОНТРОЛЬ КРИОГЕННОЙ ТЕМПЕРАТУРЫ

BELCRYO X

Улучшите свои измерения адсорбции с помощью BELCRYO X — криостата с прецизионным контролем, разработанного для бесшовной интеграции с серией BELSORP. Расширяя контроль температуры от 50 K до 473 K (-223°C до 200°C), BELCRYO X обеспечивает высокостабильные и воспроизводимые измерения в широком диапазоне экспериментальных условий — без необходимости использования жидкого азота.

Это делает его идеальным для передовых исследований, таких как анализ удельной поверхности по BET, распределение по размерам пор, хранение газов и исследования разделения газов. В сочетании с BELSORP MAX X / MAX G, BELCRYO X позволяет: точные измерения изотерм адсорбции при нескольких температурах; надежная оценка изостерического тепла адсорбции; расширенные возможности для криогенного хранения и разделения газов; полностью управляемая программным обеспечением и автоматизированная работа через программное обеспечение BELCONTROL.



BELSORP MAX X SERIES

SPECIAL MODELS

BELSORP MAX X HT

The BELSORP MAX X HT is a special model enabling various types of vapor adsorption (water vapor, VOCs, and more) at higher temperatures than the regular version. The manifold block can be heated up to 80°C, enabling a wider application range under more realistic conditions.

- | Cement, concrete and building materials
- | Heat transformation / air conditioning
- | Electrode battery (LiB) & GDL fuel cells

BELSORP MAX X HP

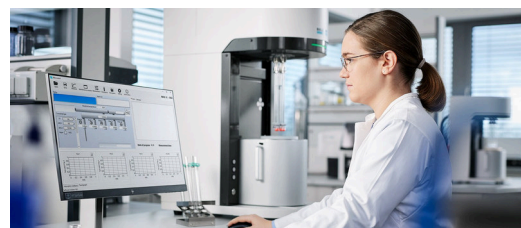
The BELSORP MAX X HP has been added as a custom solution to the BELSORP MAX X product line to enable gas adsorption, BET surface area, pore size distribution, vapor adsorption, and the evaluation of adsorption rates at high pressure up to 900 kPa.

- | Efficient utilization of CO₂
- | Energy storage (CH₄ / CH₃C₆H₁₁ / H₂)
- | Heat pumps
- | Air separation material used in PSA / TSA

SIMULTANEOUS MEASUREMENT OF UP TO 4 SAMPLES

MAXIMIZE YOUR THROUGHPUT

BELSORP MAX X offers four independent ports and one dedicated port for saturated vapor pressure measurement. Up to three ports are equippable with a unique set of pressure transducers (0.0133 kPa, 1.33 kPa, 133.3 kPa) for better micropore analyses, allowing fully independent and simultaneous measurements over a wide range. Two measurement modes can be selected depending on the application. The High Precision Mode and the Multi-sample Mode are both available for measurements starting at lowest relative pressure $P/P_0 = \sim 10^{-9}$.



QUALITY & REPRODUCIBILITY

The high-precision mode allows the simultaneous acquisition of adsorption / desorption isotherms for up to three samples. The fourth port uses an empty sample cell as a reference for the precise measurement of free space/dead volume changes (patented AFSM™ technology). In addition, a special port allows accurate measurement of the saturation vapor pressure at any time. This mode is recommended for research and development purposes, e.g. for evaluating small sample volumes in material development.



The multi-sample mode allows the user to obtain adsorption / desorption isotherms of up to four samples simultaneously, while the saturation vapor pressure is determined at any time via a dedicated port. Unlike the high precision mode, the calculation of the free space change in the sample tube is based on a pre-loaded measurement file. This mode is recommended for applications such as quality control, when samples were already characterized in large quantities.



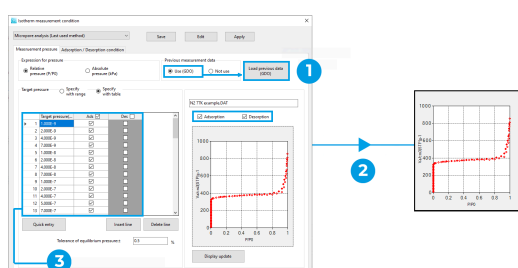
REDUCTION OF MEASUREMENT TIME

GAS DOSING OPTIMIZATION

By uploading a previously measured adsorption isotherm, the optimum measurement conditions for the samples are automatically determined. Each measuring point can be conveniently added or deleted, allowing the user to easily determine the gas injection quantity.

FEEDBACK CONTROL OF GAS INLET VALVE

By determining the gas inlet pressure according to the installation environment (secondary pressure of the gas cylinder) before measurement, the control valve is automatically optimized for speed and performance, successfully reducing the measurement time.



1. Load an existing isotherm | 2. Display of expected isotherm | 3. Input of measurement range | 4. Automatic optimization of conditions such as gas introduction volume

BELSORP MAX X SERIES

SUPPORT OF A WIDE RANGE OF ADSORBENTS & MEASUREMENT CONDITIONS

Various gas and vapor adsorption measurements are possible. With dedicated accessories, a wide temperature range can be maintained during analysis or pre-treatment.

- | N₂ / Ar evaluation of specific surface area and pore distribution by adsorption measurements from very low to high relative pressures
- | CO₂ ultra-micropore evaluation by adsorption measurements up to high pressures (optional)
- | Evaluation of low specific surface areas by Kr adsorption measurements
- | Adsorption measurement of NH₃, H₂, CO₂, O₂, CH₄ and other non-corrosive gases
- | Evaluation of hydrophilicity and hydrophobicity by water vapor adsorption measurement
- | Adsorption measurement of alcohol, benzene, and other non-corrosive vapors (VOCs)
- | Measurement of adsorption rate of various gases and vapors (kinetic analysis)

SUITABLE FOR MEASURING MATERIALS OF DIFFERENT SHAPES

Measurements can be made on a variety of materials, including pellets, molds, substrates, as well as powders and other materials that should not be exposed to the atmosphere. The connector is equipped with a sample tube with an outer diameter of $\varnothing 9$ mm or $\varnothing 14$ mm. Special sample tubes can be provided for larger samples, such as pellets, and smaller fine powder samples can also be easily measured with the appropriate sample tubes.

BELSORP MAX X SERIES

ТИПИЧНЫЕ ПРИМЕРЫ ПРИМЕНЕНИЯ

BELSORP MAX X can be used in a wide range of applications including catalysts, batteries, fibers, polymer materials, pharmaceuticals, pigments, cosmetics, magnetic powders, separation membranes, filters, toners, cement, ceramics, and semiconductor materials.



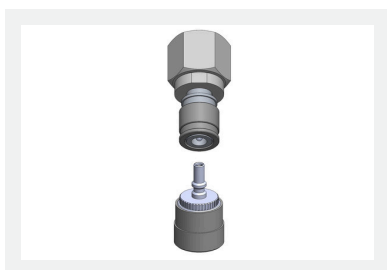
BELSORP MAX X SERIES

ДОПОЛНИТЕЛЬНЫЕ ОПЦИИ И
АКСЕССУАРЫ**STANDARD ACCESSORIES**

The BELSORP MAX X is delivered with a wide range of standard accessories like Dewar vessel, thermal insulation cover / sleeve, P_0 tube, sample cells, glass rods, sample funnel, sample cell holders, sample scattering prevention filter, reference sample, O-rings and more.

**EXTENSIVE PRODUCT LINE-UP**

Various models are available for a variety of gas and vapor adsorption measurements. Microtrac proposes the most suitable model by combining pressure sensors according to the number of samples and pore distribution evaluation range.

**AIRGUARD MEASUREMENT SYSTEM**

Измерительная система AirGuard позволяет проводить точный анализ площади поверхности по методу BET и распределения по размерам пор на приборах BELSORP, защищая чувствительные образцы от воздействия влаги и кислорода. Это особенно важно для функциональных материалов, которые могут реагировать с воздухом, потенциально изменяя их структуру или выделяя коррозионные газы. Благодаря простой установке в один клик, AirGuard обеспечивает высокоточные измерения без увеличения времени анализа. Это доступное обновление, которое также может быть установлено на существующие системы BELSORP, обеспечивая надежный анализ без загрязнений.

MORE BELCONTROL FEATURES

- | Overlaying adsorption / desorption isotherms and comparing measured data between the various ports during measurement
- | All pressures, temperatures, valve actuations, etc. are stored in trend data, allowing for immediate examination
- | A system check function is available for diagnosing the instrument status
- | E-mail notification automatically transmits measurement status and results
- | Interactive program in Japanese or English ensures easy, reliable operation
- | Extensive help functions, including step-by-step instructions during operation

АНАЛИЗАТОР ПЛОЩАДИ ПОВЕРХНОСТИ И РАСПРЕДЕЛЕНИЯ ПОР ПО РАЗМЕРАМ

BELCONTROL: NEW OPERATION SOFTWARE

The versatility of BELSORP equipment is truly world leading. The numerous features and capabilities are complemented by BELCONTROL the intuitive and user-friendly operation software. It guides the user step-by-step through the analysis process. This includes the setup of analysis conditions, executing the measurements, when to fill and setup the liquid nitrogen or other bath, when to replace the gas cylinder, the degassing steps, and much more. The software is designed to make the instrument accessible and operable to everyone, including inexperienced users.

For inexperienced users or for measurements of unknown samples, BELCONTROL only requires basic sample information (name, mass, etc.), pre-treatment conditions (if not performed externally) and the measurement range.

Detailed control of the configuration and measurement settings is possible to optimize the measurement conditions (e.g. dosing settings, equilibrium criteria, leak test option, etc.). This allows the user to fully customize the sample analysis to his needs.

FUNCTION	BELCONTROL	APPLICATION
Quick BET	Да	Multi-point BET surface area in less than 20 minutes
Helium-Free Measurement	Да	AFSM™2 enables He-free measurements with unmatched accuracy
Adsorption Kinetics	опционально	Rate of adsorption measurements for diffusion analysis

BELSORP MAX X SERIES

BELMASTER ANALYSIS SOFTWARE

Данные можно анализировать перетаскиванием. Легко можно изменять наложение графиков, масштабирование осей X-Y, конвертацию единиц, маркеры точек и цвета. Цвет можно установить для отдельных данных, чтобы улучшить видимость одних и тех же данных в разных типах анализа. Экран с результатами анализа можно сохранить. Даже если компьютер выключен, анализ можно повторить из сохраненного состояния при перезапуске компьютера. Результаты анализа можно легко преобразовать в формат MS Excel с помощью перетаскивания.

BELSORP MAX X SERIES

BELMASTER ANALYSIS PROGRAMS

Функция рутинных настроек анализа полезна при многократном выполнении одного и того же анализа. Пользовательские данные можно сохранять в качестве эталонных изотерм для анализа распределения пор, t-графика и α_s . Все операции можно просмотреть одним щелчком правой кнопки мыши. Включено программное обеспечение BELSIM (QSDFT / NLDFT / GCMC) для анализа распределения пор методом моделирования. Легкое преобразование в MS Excel выполняется одним щелчком мыши.

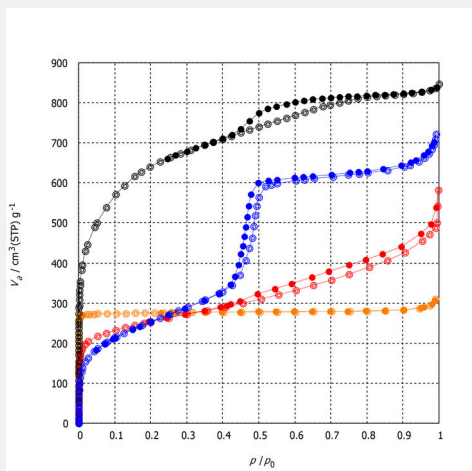


BELMASTER SOFTWARE

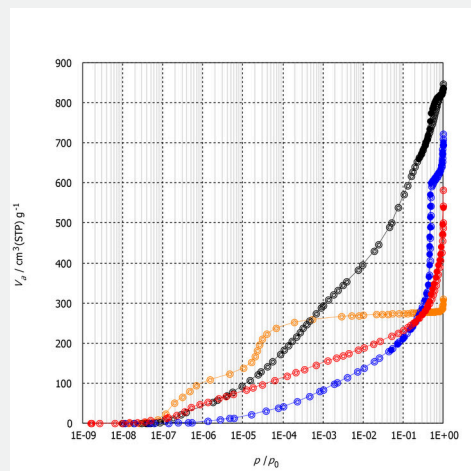
- | Adsorption / desorption isotherm
- | PCT curve
- | BET specific surface area and Type I (ISO9277) BET automated analysis
- | Langmuir specific surface area
- | BJH, DH, CI, and INNES methods (mesopore distribution)
- | HK, SF and CY methods (micropore distribution)
- | t-plot method (micro to mesopore analysis)
- | α_s plot method (micro- to mesopore analysis)
- | MP method (micropore distribution)
- | Dubinin-Astakhov method (micropore volume)
- | Equivariant differential heat of adsorption
- | Differential adsorption isotherm
- | Fractal dimension
- | Molecular probe method (ultra-micropore analysis)
- | Adsorption rate analysis
- | QSDFT / NLDFT / GCMC (распределение от микро к мезо / макропоры)

Microtrac обеспечивает анализ распределения по размеру пор следующего поколения с помощью передовых методов QSDFT, NLDFT и GCMC, преодолевая ограничения традиционных подходов за счет обеспечения унифицированной высокоточной характеристики в широком диапазоне размеров пор от 0,35 до 500 нм. В сочетании с серией BELSORP для точных измерений изотерм адсорбции это решение обеспечивает надежную и эффективную оценку поровых структур. BELMaster имеет обширную библиотеку из 59 ядер для таких газов, как N₂, Ar и CO₂, что позволяет проводить индивидуальный анализ с учетом свойств поверхности материала и формы пор для различных типов материалов (цеолиты, мезопористый силикагель, активированный уголь и др.).

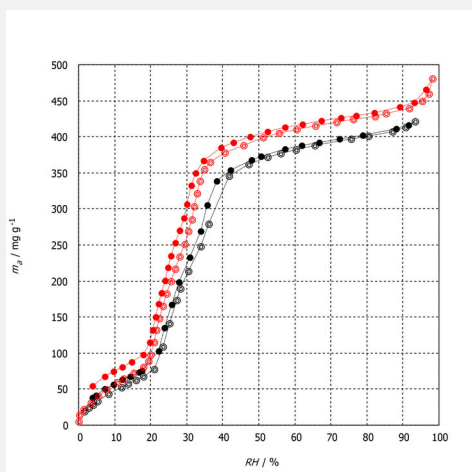
ПРИМЕРЫ ИЗМЕРЕНИЙ



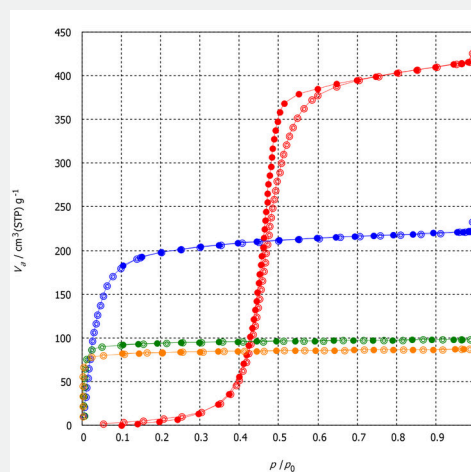
Nitrogen adsorption measurements at 77K of activated carbon fibre (black), MCM-41 (blue), metal-organic framework MIL-160 (orange) and PdC catalyst (red)



Logarithmic scaled nitrogen adsorption measurements at 77K of activated carbon fibre (black), zeolite MCM-41 (blue), metal-organic framework MIL-160 (orange) and PdC catalyst (red)



Water sorption measurements of metal-organic framework UiO-66 at 25 °C (red) and 40 °C (black)



Various vapor adsorption measurements of activated carbon fibre H_2O at 20 °C (red), CH_3OH at 15 °C (blue), C_6H_6 at 20 °C (green), and CCl_4 at 20 °C (orange)

BELSORP MAX X SERIES

ХАРАКТЕРИСТИКИ

Принцип измерения	Manometric method (volumetric method) + AFSM™ or AFSM™2
Адсорбция газа	N ₂ , Ar, CO ₂ , H ₂ , Kr, O ₂ , NH ₃ , NO, CO, CH ₄ , C ₂ H ₆ , C ₃ H ₈ , n-C ₄ H ₁₀ , iso-C ₄ H ₁₀ and further (non-)corrosive gases
Адсорбция паров	H ₂ O/water, C ₆ H ₆ /benzene, C ₆ H ₅ CH ₃ /toluene, CH ₃ OH/methanol, C ₂ H ₅ OH/этанол, n-C ₅ H ₁₂ /n-pentane, n-C ₆ H ₁₄ /n-hexane, c-C ₆ H ₁₂ /c-hexane, CH ₂ Cl ₂ /dichloromethane, CCl ₄ /тетрахлорметан и другие органические пары
Порты газа	3 порта (опция: до 12 портов)
Количество измерений	MAX X: max. 4 ports simultaneously MAX X-HT: max. 4 ports simultaneously MAXX-HP: max. 3 ports simultaneously
Диапазон измерений (удельная поверхность)	0,01 м ² /г и выше (N ₂) 0,0005 м ² /г и выше (Kr) (в зависимости от плотности образца)
Диапазон измерений (распределение пор по размерам)	0.35 - 500 нм
Measurement range (gas adsorption isotherm)	MAX X: P/P ₀ = 10 ⁻⁸ ~0,997 (N ₂ @77.4K, Ar@87.3K) MAX X-HT: max. P/P ₀ = 10 ⁻⁶ ~0,997 (N ₂ @77.4K, Ar@87.3K) MAXX-HP: P/P ₀ = 10 ⁻⁸ ~0.997 (N ₂ @77.4K, Ar@87.3K)
Диапазон измерений (изотерма адсорбции пара)	MAX X: P/P ₀ = ~0.95 @40°C MAX X-HT: P/P ₀ = ~0.95 @80°C MAXX-HP: P/P ₀ = ~0.95 @40°C
Measurement range (high pressure gas adsorption isotherm)	MAX X: - MAX X-HT: - MAXX-HP: 10Pa~900kPa
Pressure transducer (1MPa: 7500 Torr)	MAX X: - MAX X-HT: - MAXX-HP: 1 unit
Датчик давления (133 кПа: 1000 Torr)	MAX X: 6 units MAX X-HT: 6 units MAXX-HP: 5 units

BELSORP MAX X SERIES

ХАРАКТЕРИСТИКИ

Датчик давления (1,33 кПа: 10 Торр)	MAX X: max. 4 units MAX X-HT: 4 units MAXX-HP: 3 units
Датчик давления (0,0133 кПа: 0,1 Торр)	MAX X: max. 3 units MAX X-HT: - MAXX-HP: 2 units
Термостатическая воздушная печь	MAX X: 50°C MAX X-HT: 80°C MAXX-HP: 50°C
Вакуумметр / насос	Cold cathode gage (Optional)/Turbo molecular pump + rotary pump (or diaphragm pump)
Температура измерения (сосуд Дьюара)	LN ₂ , температура LAr; время удержания: 80 ч
Температура измерения (нагреватель предварительной обработки)	50 - 550°C
Температура измерения (водяная баня)	-10 - 80°C (constant temperature circulator)
Размеры (Ш x В x Г)	360 x 870 x 590 мм
Вес (основной корпус)	50 kg
Используемый газ	He, adsorption gas pressure: 0.1MPa (G) Joint: 1/8" Swagelok joint Valve operan gas pressure: 0.5 - 0.6 Mpa (G) Joint: 1/4" one-touch pipe contact
Используемая мощность	AC 100 - 240 V/400W (rotary pump not included)
CE certified	да
Операционное программное обеспечение	Операционная система Windows 10 или выше, процессор Intel(R) Core i5 или выше 2 ГБ оперативной памяти или более, 5 ГБ места на жестком диске или более
Рекомендуется Монитор	Мониторы с разрешением Full HD

HIGH-PRECISION GAS AND VAPOR ADSORPTION ANALYZER

BELSORP MAX X SERIES

СВЯЖИТЕСЬ С НАМИ

microtrac.com/ru/contact/contact-form/?prefilltext=contact_form.request&product=625

ЗАПРОС ПРЕДЛОЖЕНИЯ

[microtrac.com/ru/contact-services/quote-request-form/?
prefilltext=contact_form.quote_request&product=625](https://microtrac.com/ru/contact-services/quote-request-form/?prefilltext=contact_form.quote_request&product=625)



MICROTRAC
a **VERDER** company

microtrac.com/ru/products/gas-adsorption-measurement/surface-area-pore-size-distribution/belsorp-max-x/

© Microtrac – microtrac.com / Content may be subject to modifications or corrections