

**Multi-sample BET specific surface area  
measurement instrument**

# BELSORP-MR6

Specific surface area  $0.01\text{m}^2/\text{g} \sim$



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Specialists in Adsorption

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# High through-put specific surface area for quality control

## Features

- Capable of continuous 6-sample measurement automatically
- Simultaneous process of pretreatment and measurement realizes efficiency (15min/sample \*1)
- Another sample can be added by using the sample exchange station
- Capable of the multi-point specific surface area measurement by using the gas mixer (not requiring the gas mixture cylinder) \*2
- Capable of installing the automatic liquid nitrogen supply system \*2
- Capable of correcting the  $P_0$  (saturated vapor pressure) with the real-time liquid nitrogen temperature measurement \*2

\*1: Depends on the sample \*2: option



## Principle

BET [Brunauer-Emmett-Teller] specific surface area measurement is one of very important analytic methods that is utilized for the evaluation of powder and porous materials.

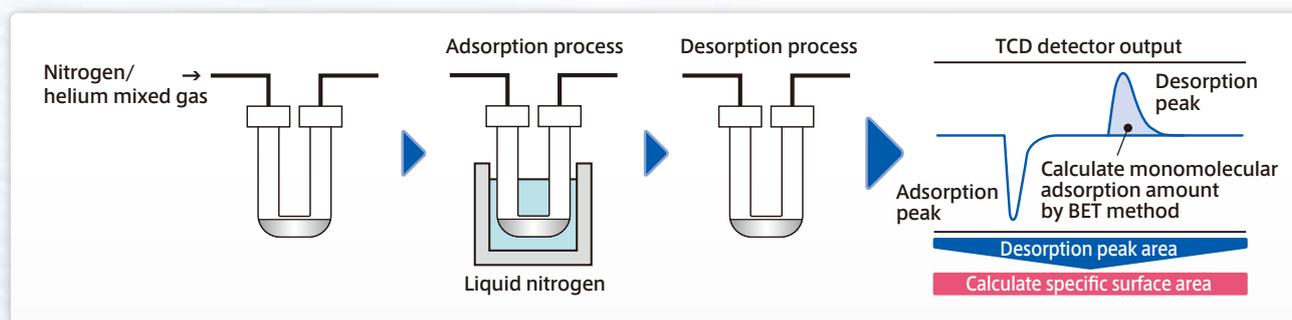
### Flow gas adsorption method

With the dynamic flow gas adsorption method, the sample is cooled by liquid nitrogen while supplying a certain flow level of adsorptive gas (nitrogen, etc.) of specified density to helium.

If nitrogen is adsorbed to the sample and the nitrogen density is reduced in the mixed gas, the peak is obtained from the thermal conductivity detector (TCD) signal.

When the desorption equilibrium is attained, the detector signal returns to the base line.

The desorption peak is normally used for calculation since it is sharp and fits the accurate integration.

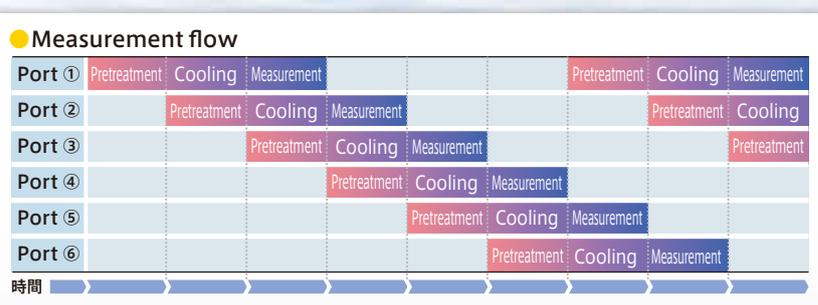


### High-throughput measurement with the simultaneous process

Pretreatment, cooling and measurement are processed simultaneously for efficient measurement.

In the general condition, pretreatment is the bottleneck that requires the longest time.

If the pretreatment time is 20 minutes, the measurement time per a sample is 20 minutes.



## Software

Our unique software enables measurement and data output with simple operations and can be utilized for quality control, R&D, etc.

- Simple measurement with the input of pretreatment conditions, sample name and sample weight.
- The pretreatment condition of temperature and time is individually configurable for each port.
- The repeat measurement for the reproducibility is available for each port.
- The file name is automatically created with the date of measurement and one or more selections from port number, cell ID, sample name and lot number.
- The sample requiring long pretreatment time can be separately pretreated in advance of measurement.
- Automatic calibration measuring actual real-time temperature and pressure assures high reproducibility and reliability.
- Once a port completes a measurement, another sample can be set without intervention.
- The automatic valve is equipped and no gas is consumed when measurement is not in process.

### Measured data table

- Indication and output of measurement result table and details are available.
- The chart of selected data is indicated and an error can be found at once if any.
- One-touch sorting is available by sample name, measurement date, etc.
- The table data is output to the CSV file and can be managed with Excel, etc.
- The detail data can be output to the report format.
- For food and drug applications, our software is compliant with the 21 CFR Part 11 (option)

### Data output example

#### 1 Label

Measurement date, File name, Measurer, Sample name, Lot number, Sample weight, etc.

#### 2 Measurement conditions

Pretreatment temperature, Pretreatment time, Adsorbate density, etc.

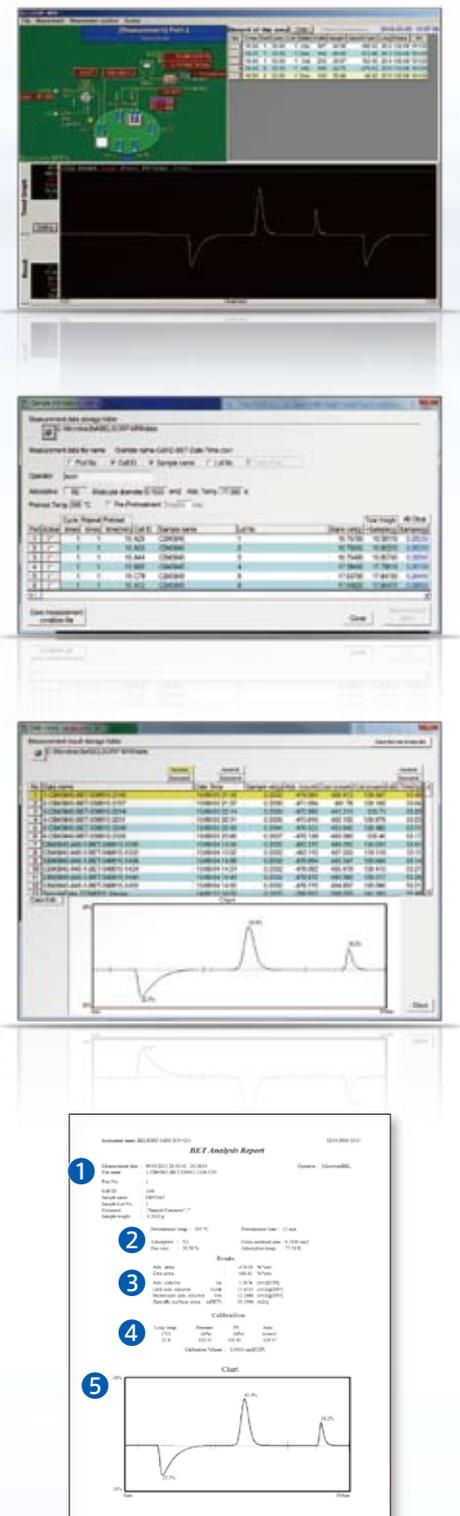
#### 3 Measurement result

Total adsorption amount, Unit adsorption amount, Monomolecular adsorption amount, Specific surface area

#### 4 Calibration measurement

Calibration loop temperature, Pressure, Saturation vapor pressure, Peak area.

#### 5 Chart



## Applications

BELSORP-MR6 can be used in various fields such as catalyst, fuel cell, battery, textile, polymer materials, medicine, pigment, cosmetics, magnetic powder, separation membrane, filter, toner, cement, ceramic, semiconductor materials, etc.



Catalyst



Battery



Medicine



Cosmetics



Cement



Toner



Pigment



Electronic component



Mineral

# Options

## Gas mixer

Capable of BET multi-point measurement with mixture of N<sub>2</sub>/He at any ratio.  
Capable of more accurate BET specific surface area evaluation

## Automatic liquid nitrogen supply system

Liquid nitrogen is automatically supplied with the fluid level sensor.  
Measurement is not interrupted with liquid nitrogen shortage.

## Real-time correction of the liquid nitrogen temperature

P<sub>0</sub> (saturated vapor pressure) is corrected with the real-time liquid nitrogen temperature measurement.  
Capable of the stable measurement without the environmental influences.



## About BET analysis (multi-point method and single point method)

From the adsorption equilibrium pressure and the adsorption amount under the pressure, the monolayer adsorbed gas quantity, *V<sub>m</sub>* is calculated by BET theory. The specific surface area can be obtained from *V<sub>m</sub>* and the cross sectional area of an adsorbed molecule. Also, the C value obtained from the BET plotting is reflected from the adsorptive heat and it varies depending on the shape of adsorption isotherm. If the adsorption isotherm rises at the low pressure section, the C value is large (large adsorptive heat). Otherwise or if adsorption amount is small, the C value is small. The BET single point method is simple where the measurement point is limited to one while supposing the C value is infinite, and short-time measurement is available. This is mainly used for the quality control. Please note the difference from the multi-point method is large when using a sample with a small C value. When using the gas mixture option, the BET multi-point measurement is available with a mixture of N<sub>2</sub> and He at any mixture ratio. You do not need to prepare many pieces of N<sub>2</sub>/He gas cylinders. Either the single point or multi-point method is selectable by setting, depending on the application.



$$\frac{P}{V(P_0 - P)} = \frac{1}{CV_m} + \frac{C-1}{CV_m} \cdot \frac{P}{P_0}$$

**BET method (multi-point method)**

The specific surface area is calculated with the monomolecular layer adsorption amount obtained by the BET plotting

$$\frac{P}{V(P_0 - P)} = \frac{1}{V_m} \cdot \frac{P}{P_0}$$

**BET method (single point method)**

The specific surface area is calculated with the monomolecular layer adsorption amount obtained when the C value is supposed infinite.

● The single point specific surface area measurement with the difference of the C value when setting the BET multiple-point method to one

C value	S <sub>1</sub> /S <sub>BET</sub>		
	P/P <sub>0</sub> =0.3	P/P <sub>0</sub> =0.25	P/P <sub>0</sub> =0.2
10	0.811	0.769	0.714
20	0.896	0.870	0.833
50	0.955	0.943	0.926
100	0.977	0.971	0.962
200	0.988	0.985	0.980

## Example of BET multi-point measurement data output

### 1 Label

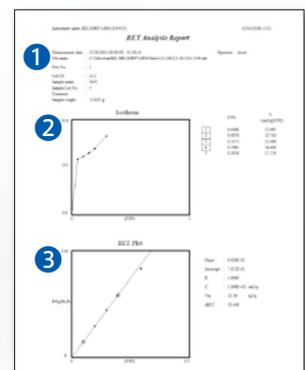
Measurement date, File name, Measurer,  
Sample name, Lot No., Sample weight, etc.

### 2 Measurement result

Adsorption isotherm, relative pressure and unit adsorption amount

### 3 BET analysis result

BET Plot, slope, section, correlation coefficient  
C value, monomolecular layer adsorption amount, specific surface area



## Specifications

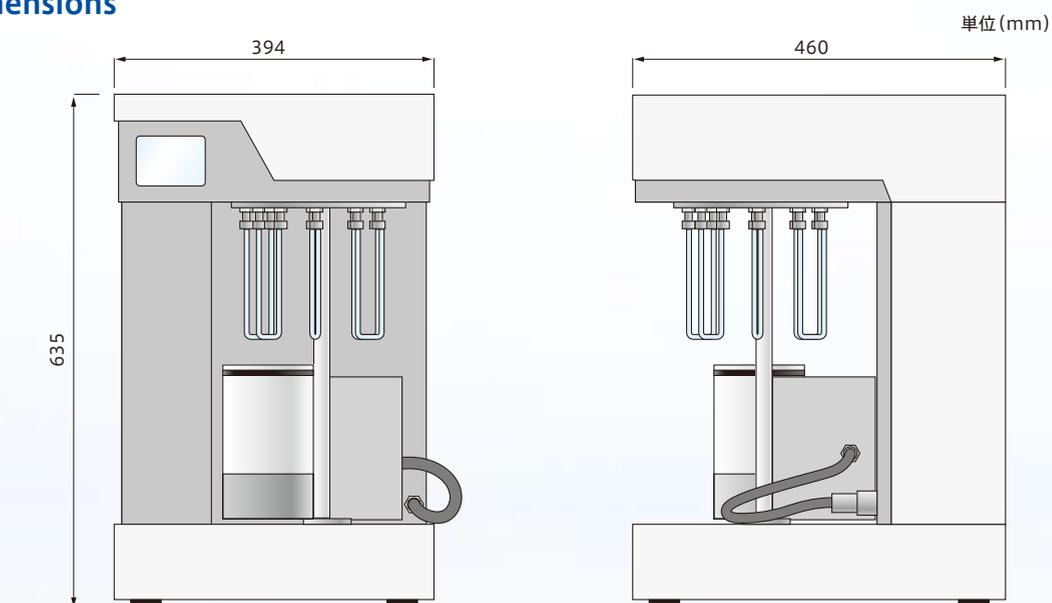
Principle	Dynamic flow gas adsorption method
Measurement mode	BET single point method, BET multi-point method (option)
Number of measured samples	6 samples
Adsorption gas	N <sub>2</sub>
Pretreatment temperature	Up to 400°C
Relative measurement pressure	0.3, 0.02~0.9 (option)
Measurement time	Approx. 15 min./sample (excluding pretreatment time) ※Depends on the sample
Specific surface area measurement range	0.01m <sup>2</sup> /g or more
Reproduction	±1% ※by sampling
Dimensions, Weight	394(W) × 635(H) × 460(D)mm 48kg
Power	AC100V/AC200V, 600W, 50/60Hz

※Due to our policy of continuous improvement, the specifications are subject to change without notice.

## Supplies

Model number	Description
090-20001-0-0	Low-capacity reference sample tube
090-20002-0-0	Reference sample tube
900-00001-0-0	Viton O-ring (12pcs/set)
060-20034-0-0	Filter element (6pcs/set, 8mm diameter)
060-20009-0-0	Sample tube stand (for weighing)
060-21007-0-0	Sample tube stand (for 6 tubes)
990-00004-0-0	Reference sample for specific surface area measurement Carbon black 0.3g

## External dimensions





※Specifications and appearance of the products listed are subject to change without notice.  
※Products (goods and services) described in the catalog, depending on the destination and application, might be applicable to export regulations, etc. by the "Foreign Exchange and Foreign Trade Control Law".  
In response to the review of the Japanese government regarding the export of products (goods and services), permission and approval, and the like, must be obtained according to the regulations.



8-2-52 Nanko-Higashi, Suminoe-ku, Osaka, 559-0031, Japan

TEL : +81-6-7166-2162

FAX : +81-6-4703-8901

<http://www.microtrac-bel.com/en/>

E-mail : [international@microtrac-bel.com](mailto:international@microtrac-bel.com)

● Distributor

NIKKISO Group