BELSORP-mini II

High precision surface area and pore size analyzer

Up to 3 independent samples measured simultaneously

High accuracy (AFSM™)

Compact design

BEL

BEL JAPAN, INC.

BELSORP-miniⅡ OVERVIEW

BELSORP-miniⅡ is a compact, precision instrument for measuring surface area and pore size distribution by the volumetric gas adsorption technique. Our new patented AFSM™ method for the measurement of dead volume enables the BELSORP-miniⅡ to achieve the highest accuracy and repeatability. Powerful and easy to use software "BEL Master™" makes the BELSORP-miniⅡ ideal for both research and QC applications.

FEATURES

■ Multi-sample measurement

The BELSORP-miniⅡ is equipped with 3 independent sample measurement ports plus an additional port for measurement of the saturated vapor pressure. Each port has a dedicated pressure sensor enabling up to 3 simultaneous and independent sample measurements. There are two modes of operation:

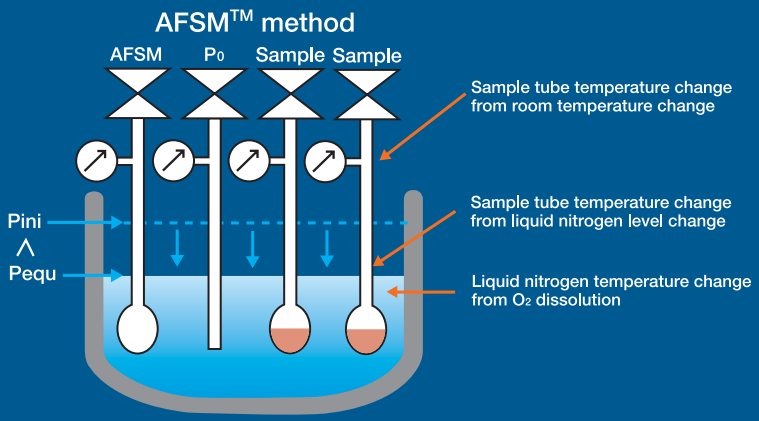
High accuracy mode : Two measurement ports are used for samples and the other two ports are used for measurement of the saturated vapor pressure and dead volume. The high accuracy mode is used for samples with very small surface areas or whenever the most accurate data is required.

Standard mode : Three ports are used for sample measurement and the fourth port is used for measurement of the saturated vapor pressure. The change in dead volume is calculated from a calibration based on a prior measurement. Standard mode is used to achieve higher sample throughput and is ideal for QC applications.

■ AFSM™ method (Advanced Free Space Measurement, patented by BEL Japan)

BEL has developed a unique method to compensate for dead volume in the sample tube. Conventional instruments require that the liquid nitrogen level be kept constant during the sample measurement process to avoid changes in dead volume created by temperature variations in the top of the sample tube. This results in large consumption of liquid nitrogen or requires a complicated liquid nitrogen control system.

The BELSORP-miniⅡ does not require a constant liquid nitrogen level. The change in dead volume caused by variation of liquid nitrogen level, liquid nitrogen temperature, and atmospheric temperature is measured directly in a separate sample tube (see picture to the right).For high accuracy measurements, the dead volume measurement is performed at the same time as the sample measurement. In high throughput applications, the dead volume measurement can be measured prior to the sample measurement and stored. This new method compensates for dead volume changes throughout the whole apparatus and allows for high accuracy data to be collected without time consuming or wasteful liquid nitrogen management.



〈High accuracy mode〉

■ Saturation vapor pressure measurement

BELSORP-miniⅡ is equipped with the port for saturation vapor pressure measurement (P_0) and pressure sensor as standard equipment. Since it measures the saturation vapor pressure at every adsorption measurement point, it is possible to measure up to the high relative pressure range (i.e. up to macro pore size) with the high reproducibility.

■ High functionality

- Software control provides completely automated measurement, reducing the possibility for human error while achieving increased reliability and repeatability.
- Up to 4 BELSORP-miniⅡ units can be controlled by a single computer
- Data analysis can be carried out during a sample measurement
- Valve switching is software controlled through a user friendly interactive schematic interface

■ Wide measurement range and high sensitivity

- The BELSORP-miniⅡ can measure pore sizes from 0.35 to 200 nm in diameter. Pore volume is determined with 0.025 μL resolution.
- The BELSORP-miniⅡ can measure very low specific surface areas, down to 0.01 m^2/g with high accuracy and without the use of Kr gas.
- By reducing the volume of free space (minimum $3cm^3$), the sensitivity of adsorption/desorption measurement is increased significantly.

■ ISO 9277 and JIS Z 8830 compliant

SOFTWARE and DATA

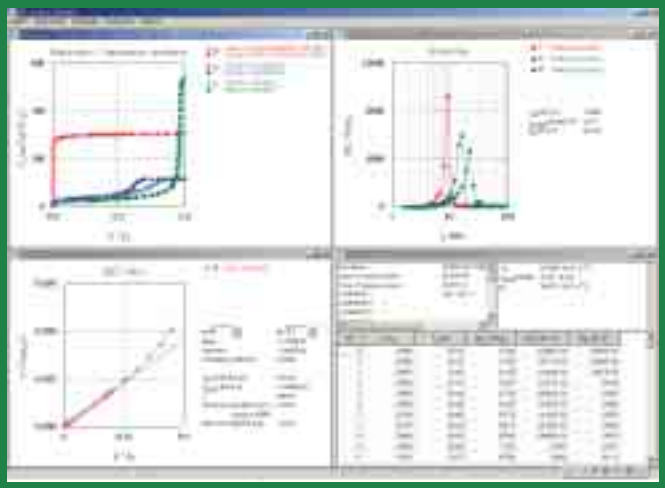
The user friendly BELSORP-miniⅡ Windows software combines sophisticated analysis features with easy to use measurement functions. A variety of formats are provided for high quality report generation.

■ Measurement Program

- High throughput measurement sequence control.
- Display of instrument status, trend chart and real-time isotherm.
- Measurement parameters can be altered during sample measurement.
- System check program for instrument status and diagnostics.
- Interactive instrument schematic for control of valves. Simply click the appropriate symbol on the schematic

■ Analysis Program (BEL Master™)

- Simple drag and drop data manipulation
- Support of data overlays for comparing different samples
- Export data to spreadsheet and plotting programs using CSV data file format.
- Set preferred analysis options using the Routine Analysis Function.
- User can create custom reference isotherms for t-curve and αs analysis
- Analysis options:
  Adsorption/Desorption isotherm
  BET method
  Langmuir method
  BJH/CI/DH method
  αs plot
  t plot
  MP method
  Dubinin-Astakhov
  Difference of adsorption isotherms
  Molecular probe method
  BEL Sim™ (NLDFT/GCMC analysis) *optional

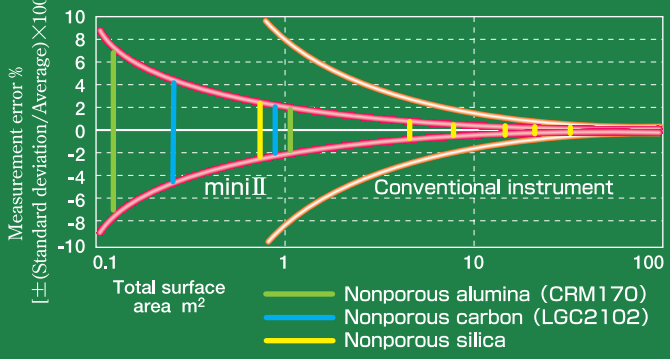


■ Measurement Accuracy of Surface Area

- High accuracy mode
  Resolution: 0.01m²
  Reproducibility: Total surface area 0.3 m² → ±5.0%
  Total surface area 1 m² → ±1.5%
  Total surface area 10 m² → ±0.4%
- Standard mode
  Resolution: 0.01 m²
  Reproducibility: Total surface area 10 m² → ±0.5%

*The total surface area (m²) is different from the specific surface area (m²/g)

■ Reproducibility of BELSORP-miniⅡ

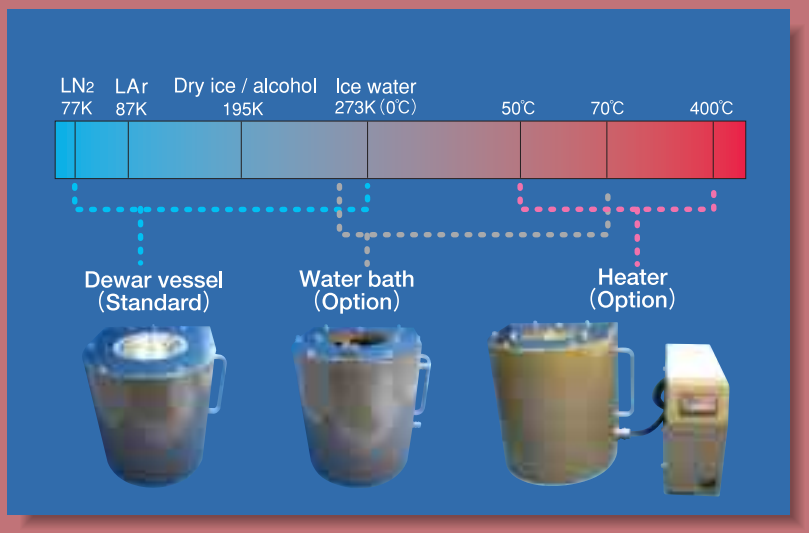


SPECIFICATIONS

Measurement principle	Volumetric gas adsorption method + Advanced Free Space Measurement (AFSM™)	
Gas	N_2, Ar, CO_2, H_2, Methane, Butane and other non-corrosive gases	
Sample ports	High accuracy precision mode : 2 ports Standard mode : 3 ports	
Specific surface area	0.01 m^2/g and above (depends on sample density)	
Pore size distribution (diameter)	0.35～200 nm / Pore volume resolution 0.025 μL	
Pressure measurement	No. of pressure sensors : 5 units Measurement range : 0～133 kPa Accuracy : ＋/－0.25% of F.S.(specification of the manufacturer) Resolution : 4 Pa	
Dewar vessel	Volume : 2 L Holding time : 30 h	
Sample cell	Standard: Approx. 1.8cm^3 (9 of them) Optional: 0.5, 5cm^3	
Measurement program	Automatic adsorption/desorption isotherm measurement, system check	
Analysis program	Adsorption / desorption isotherm Specific surface area by BET method or Langmuir Micropore volume and mesopore size by t-plot, MP method or αs method Mesopore distribution by DH, CI or BJH (Please contact us about other analysis program options)	
Physical	W313mm × H640mm × D406mm 42kg (main unit) (Vacuum pump and computer excluded)	
Requirement	Computer	CPU and motherboard chip (INTEL), 128MB main memory, 1GB free area in hard disk, 1 port each for Serial and USB, 1024 x 768 screen resolution, Windows 98™ SE / 2000 / XP
	Vacuum pump	Ultimate vacuum : 1Pa and lower Volume displacement : 30L/min or higher Connection port to main unit : ϕ12mm
Utility	Gas : He, N_2, 1±0.2 bar (1/8″Swagelok joint) Power : Single phase AC100～120 or 200～240 V / 600 W (450 W for vacuum pump)	

OPTIONS

■ Measurement temperature range



Model number	Name	Specifications	Standard	Option
020-10003-0-0	Dewar vessel	LN_2 : −196℃ (77K), −78℃ (195K), 0℃ (273K)	○	
020-10002-0-0	Water bath	−10℃～70℃, closed bath		○
020-10000-0-1	Electric furnace	50℃～400℃, with the controller AC110V/330VA		○
020-10000-0-2	Electric furnace	50℃～400℃, with the controller AC220V/330VA		○

■ Sample Cells

Model number	Name	Descriptions	Quantity	Standard	Option
020-20000-0-0	Sample cell	Standard sample cell (Max. 500℃, 1.8cm^3)	3/SET	○ 3SET	
020-20001-0-0	Sample cell	Small sample cell (Max. 500℃, 0.5cm^3)	3/SET		○
020-20002-0-0	Sample cell	Large sample cell (Max. 500℃, 4cm^3)	3/SET		○
020-20003-0-0	Sample cell	Pellet sample cell (Min. bore diameter: 12mm) (Max. 500℃, 5cm^3, including springs)	1		○
020-20004-0-0	Filler rod	Glass rod (for standard and small sample cell)	3/SET	○ 2SET	
020-20005-0-0	Filler rod	Glass rod (for large sample cell)	3/SET		○
020-20006-0-0	Filler rod	Glass rod (for pellet sample cell)	1		○

■ Consumable parts

Model number	Name	Descriptions	Quantity	Standard	Option
020-20007-0-0	P_0 tube	Stainless tube	1	○	
020-20009-0-0	Funnel	Sampling glass funnel	3/SET	○	
900-00011-0-0	Filter	Sample cell filter with O-ring	6/SET	○	
900-00016-0-0	Cap	Sample cell cap	10/SET	○	
900-00022-0-0	Sample cell holder	For measuring sample weight	1	○	
900-00003-0-0	Viton O-ring	For connecting sample cell	12/SET	○	
020-20013-0-0	Dewar vessel cover	Dewar vessel top cover (for 4-port)	1	○	
900-00017-0-0	Sleeve	Thermal insulation sleeve for sample cell	3/SET	○	
020-22002-0-0	Service Pack II	Sample cell, filler, rod, P_0 tube, O-ring, cap, sleeve, filter	1		○

SAMPLE PREPARATION

Our BELPREP sample pretreatment systems for the BELSORP-miniⅡ feature 3 sample ports and continuous display of pretreatment temperature. Sample can be degassed by vacuum or flow of dry gas while heating up to 500℃.

		BELPREP-flow	BELPREP-flowⅡ	BELPREP-vacⅡ
				
Flow / Heat degassing		○	○	○
Vacuum / Heat degassing		—	—	○
Sample port		3	3	3
Gas flow control		3 (each port)	1	1
Gas flow meter		3 (each port)	—	—
Ultimate pressure		—	—	1Pa and below
Temperature control		3	1	1
Temperature range (max)		500℃	430℃	430℃
Temperature accuracy		±5℃	±5℃	±5℃
Physical		W387xH560xD322 19Kgs	W321xH363xD122 11Kgs	W321xH363xD122 15Kgs
Utility	N_2 gas 1±0.2bar	○	○	○
	Vacuum pump	—	—	○
Power	AC100-120 or 200-240V	300W	515W	530W (without vacuum pump)

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SORPTION INSTRUMENTS

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