ALTAMIRA INSTRUMENTS

BET Surface Area and Pore Size Analyzer

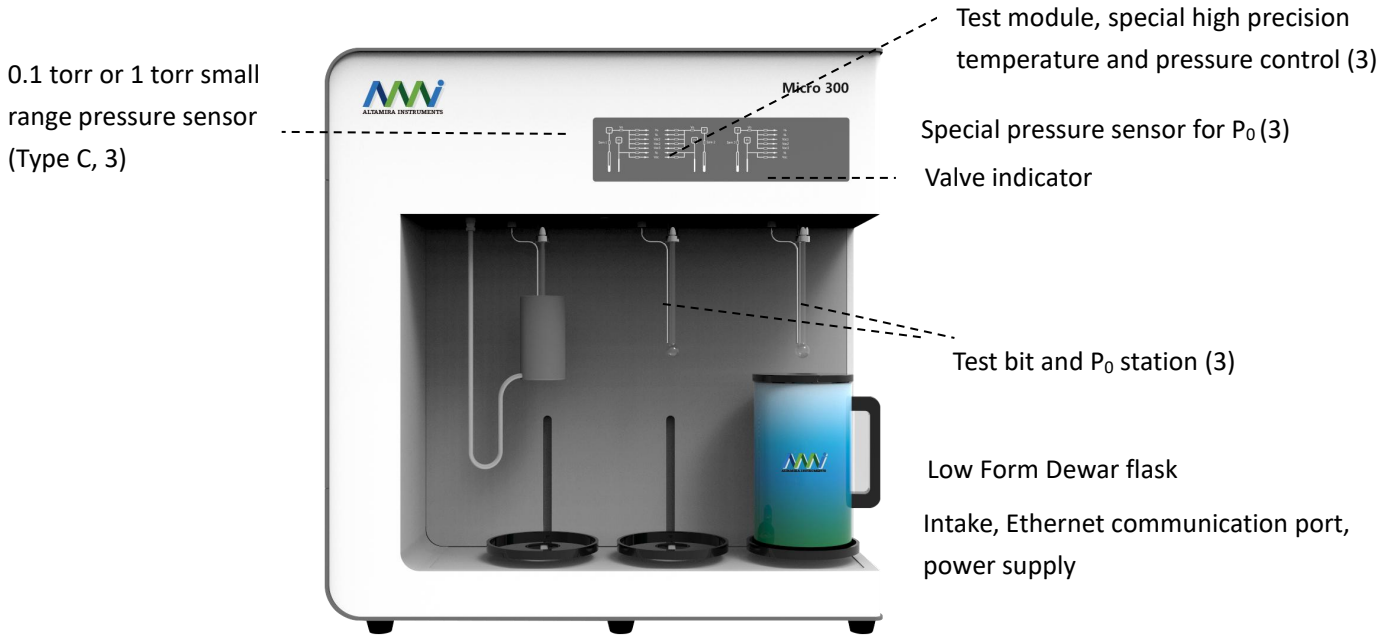
AMI 300 Series

- Single-/Multipoint BET Surface Area
- BJH Adsorption and Desorption
- Horvath-Kawazoe
- Saito-Foley

- Material Research
- Chemical Engineering
- New Energy
- Catalytic Technologies

Outline

The AMI 300 Series can accurately produce surface area and pore size results of powder materials. According to the different test functions, this series of instruments are divided into three types, there are A, B, and C. Every analysis station has its own dedicated dosing manifold for optimal analysis duration. The C type is configured with 1 torr or 0.1 torr high-sensitive pressure sensors and turbo molecular pump with ultimate pressure of 10^{-8} Pa. The three analysis stations can also be used for in-situ sample preparation to avoid sample contamination. It can effectively take microporous analysis of microporous materials such as molecular sieve, catalyst, activated carbon, and other microporous materials.



Structural distribution diagram of AMI 300 Series

Range of Pore Diameter
0.35 – 500 nm

Range of Specific Surface Area
> 0.0001 m^2/g

Repeatability of Median Pore Diameter
< 0.02 nm

Repeatability of Specific Surface Area
±1%

Features

Test Module

Internal temperature of test module can be controlled through Real-time monitoring, ensuring accuracy of adsorption detection.

Saturated Vapor Pressure P_0

Using independent P_0 pressure sensor for P_0 value by inching test, guarantees the reliability of experimental data. Atmospheric pressure input method to determine P_0 also be selected.

Vacuum System

It's a multi-channel, adjustable, and parallel vacuum system. Vacuum degree of this system can be controlled in segments.

This design prevents the sample from being pumped into analyzer. Meanwhile, a delicate part was designed for ensuring cleanliness of vacuum system, minimizing dust pollution.

Sample Preparation System

In addition to two pretreatment stations, the other two analysis stations can be used in preparing samples. There is no interference between pretreatment stations and analysis stations.

Degas temperature can be set individually and controlled from ambient to 400 °C.

Micropore Distribution

Accurately apply the HK method, SF method and other micropore analysis model, the aperture deviation of micropore is less than 0.02 nm.

Pressure Sensor

Micro 300C with 1torr (selectable 0.1torr) makes the partial pressure of P/P_0 up to 10^{-7} - 10^{-8} (N_2/77K) in the physical adsorption analysis.

Cold Free Space

Cold free space can be corrected by Helium automatically, ensuring accuracy of test results.

This calibration method is suitable for testing of any powder or particle material.

Control of Liquid Nitrogen level

Using High volume (3L) Dewar flasks and working with the seal cover assure a constant thermal profile along the length of sample tubes and P_0 tubes throughout testing process.

Turbo Molecular Pump

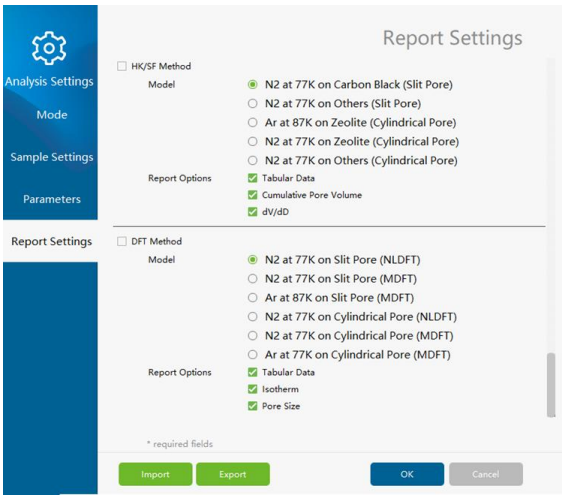
Molecular pump is a standard configuration part on the Micro 300C. The ultimate pressure is up to 10^{-8} Pa, providing a strong support for micropore analysis in the ultra-low pressure. The smallest micropore diameter can be tested is 0.35 nm.

PAS Control and Analysis Software

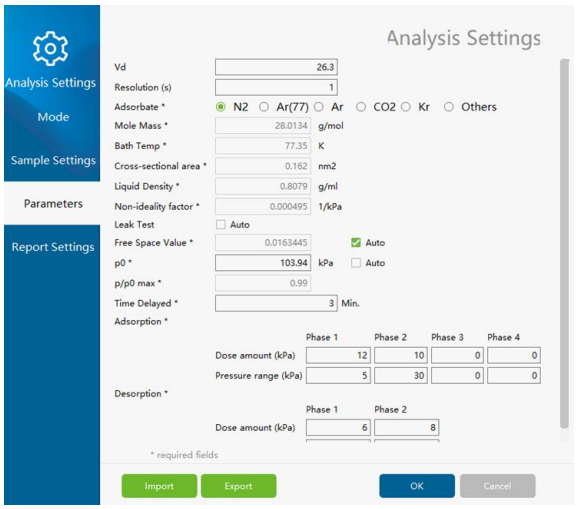
PAS Software is intelligent software in operation control, data acquisition, calculation and analysis and report generation on the Windows platform. This software can communicate with the host through the LAN port and remotely control many instruments at the same time.

Clear tabular reports include:

- Adsorption and desorption isotherms
- Single-/Multipoint BET surface area
- Langmuir surface area
- STSA-surface area
- pore size distribution according to BJH
- t-plot
- Dubinin-Radushkevich
- Horvath-Kawazoe
- Saito-Foley



PAS Software adopts a unique intake control method, the pressure in adsorption and desorption process is optimally set in six-stage; this flexible design is helpful for improving test efficiency.



Changes of the pressure and temperature inside the manifold can be observed directly in the test interface which is convenient for sample test and instrument maintenance.

Current state of analyzer can be intuitively understood with the indicator light and event bar.

Each adsorption equilibrium process is dynamically displayed on the test interface. Adsorption characteristics of the sample can be easily understood.

Typical analysis examples

BET repeatability is only 0.0015 m^2 / g in the test of very low surface area powder

ID	Pd	Pcd	P/Po	V	R	Time
2	10.57665	6.49165	0.06368	0.05149	1.32095	16:39:04
3	14.47043	10.49325	0.10300	0.05714	2.00944	16:40:34
4	20.49214	15.55271	0.15266	0.06328	2.84716	16:42:08
5	26.25142	20.97835	0.20608	0.06958	3.73044	16:43:45
6	31.09524	26.11512	0.25661	0.07540	4.57787	16:45:24
7	36.24625	31.26206	0.30719	0.08122	5.45905	16:47:06

Slope	Intercept	Vm	C	Cc
16.90313	0.25562	0.05828	67.12578	0.99997

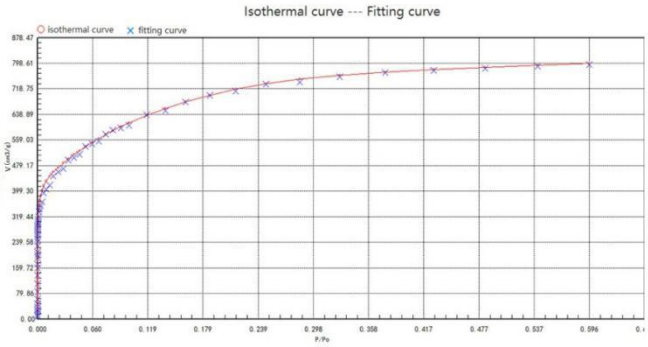
Specific surface area (m2/g): 0.25410

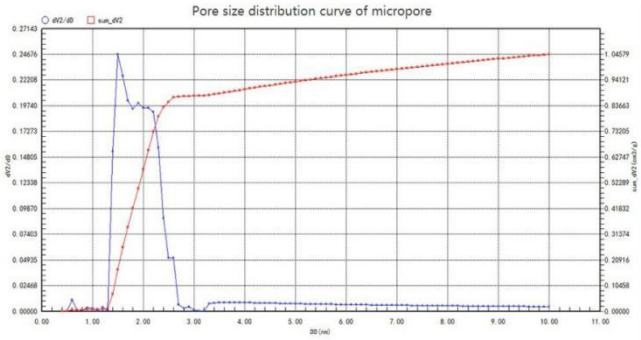
ID	Pd	Pcd	P/Po	V	R	Time
2	11.12797	7.02669	0.06872	0.05193	1.42099	14:21:24
3	15.08480	11.06897	0.10834	0.05767	2.10708	14:22:55
4	21.71276	16.45800	0.16109	0.06420	2.99078	14:24:29
5	27.29098	21.94468	0.21492	0.07083	3.86529	14:26:07
6	32.00053	27.05703	0.26512	0.07653	4.71376	14:27:46
7	37.32853	32.26907	0.31619	0.08262	5.59644	14:29:28

Slope	Intercept	Vm	C	Cc
16.78425	0.27576	0.05862	61.86487	0.99996

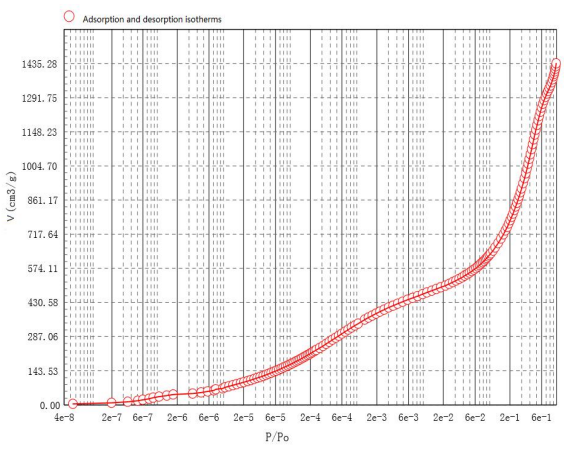
Specific surface area (m2/g): 0.25557

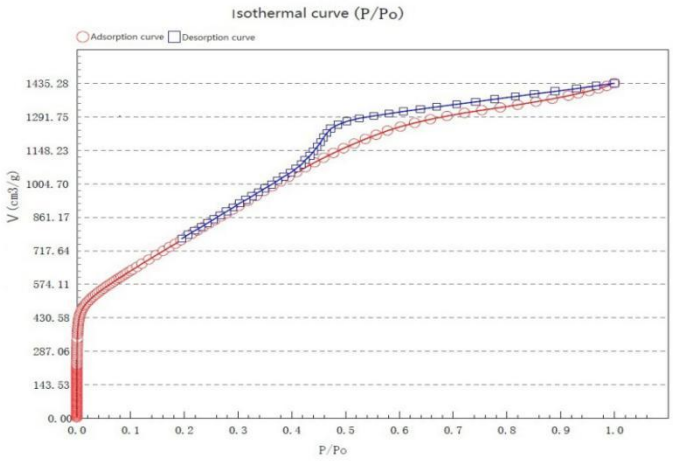
Analysis value of pore size distribution in activated carbon materials as follows:





Microporous analysis Report of carbon materials as below:





Specifications

Type	Meso 300A	Micro 300B	Micro 300C
Adsorbed Gas	Non corrosive gases, such as N_2, Ar, Kr, H_2, O_2, CO_2, CO, NH_3, CH_4, etc.		
Pressure Sensor at Analysis Station	1000 torr, 3	1000 torr, 3; 10 torr, 1 (optional 2 or 3); 1 torr (0.1torr can be selected), 1 (optional 2 or 3)	1000 torr, 3; 10 torr, 3; 1 torr (0.1torr can be selected), 3
	Accuracy: ±0.15% (F.S.)		
Pressure Sensor at P_0 Station	1000 torr, 3 (Accuracy: ±0.15% (F.S.)		
Degas System	The standard configuration is 3 stations in-situ degassing, which can simultaneously degas 3 samples under vacuum heating; Another option is external 4-station vacuum heating degassing machine		
Degas Temperature	Ambient to 400 °C. Free to set up target temperature.		
Vacuum Pump	Two-stage rotary vane mechanical vacuum pump, the ultimate pressure is $6.7*10^{-2}$ Pa	Two-stage rotary vane mechanical vacuum pump, the ultimate pressure is $6.7*10^{-2}$ Pa, optional turbo molecular pump	Turbo molecular pump (ultimate pressure 10^{-8}Pa) and front mechanical vacuum pump (ultimate pressure $6.7*10^{-2}$ Pa)
Analysis Port	Samples on the 3 analysis bits can be tested at same time (including P_0 test).		
Test Principle	Gas adsorption by static-volumetric analysis		
Measurement Range of BET Surface Area	0.0005 m^2/g to the infinity; Standard sample repeatable accuracy is less than ± 1.0%	0.0001m^2/g to the infinity; Standard sample repeatable accuracy is less than ± 1.0%	0.0001m^2/g to the infinity; Standard sample repeatable accuracy is less than ± 1.0%
Test Range of Pore Diameter	0.35 nm-500 nm; Pore dimension repeatability is less than 0.2 nm in the accurately analyses porous materials with pore size greater than 2 nm	0.35 nm-500 nm; Pore dimension repeatability is less than 0.02 nm in the accurate analysis of micropore 0.35 nm-2 nm	0.35 nm-500 nm; Pore dimension repeatability is less than 0.02 nm in the accurate analysis of micropore 0.35 nm-2 nm
Minimum Pore Volume	0.0001 cm^3/g		
Range of Relative Pressure P/P_0	10^{-5}-0.998	$10^{-6}/10^{-8}$-0.998	10^{-8}-0.998
Overall Dimension	Depth: 700 mm; width: 700 mm; height: 850 mm; weight: 80 Kg -90 Kg		
Ambient Temperature	15-40 °C		
Related Humidity	30%-60%		
Electrical Supply	AC220 V ± 20 V, 50/60 HZ, maximum power 300W;		

Applications

Applied Field	Typical Materials	Details
Material Research	ceramic powder, metal powder, nanotube	According to surface area value of nanotube, hydrogen storage capacity can be predicted.
Chemical Engineering	carbon black, amorphous silica, zinc oxide, titanium dioxide	Surface area of carbon black is one of the important factors affecting the reinforcement performance of rubber products.
New Energy	lithium cobalt, lithium manganate	Increasing surface area of electrode can improve Electrochemical reaction rate and promote iron exchange in negative electrode.
Catalytic Technologies	active alumina oxide, molecular sieve, zeolite	Active surface area and pore structure influence reaction rate.

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