PMI BET SORPTOMETER

BET-202AEL-TPD/TPR/TPO

Porous Materials, Inc.

Not just products...solutions!

Description

Fully automated vacuum volumetric, gas sorption analyzer for the measurements of Pore surface area using Argon, carbon dioxide, nitrogen, krypton (Multigas system), and other suitable gases for the highest accuracy. Two complete analysis systems are controlled by a single computer.

Applications

PMI's BET Sorptometer has a multitude of applications in industries worldwide, including industrial textiles.

Principle

When clean surface is exposed to a gas, an adsorbed film forms on the surface. Adsorbed films also form on the surface of pores within a material and vapor can condense in the pores. At a constant temperature, the amount of adsorbed/condensed gas on a surface depends on the pressure of the gas. Measurement of the amount of adsorption/condensation as a function of pressure can give information on the pore structure. The PMI Sorptometers use gas adsorption/condensation to analyze pore characteristics.

Physical Adsorption

Weak van der Waal's type interaction of molecules with a pore surface leads to physical adsorption. The Brunauer, Emmett and Teller (BET) theory of physical adsorption is normally used for analysis of adsorption data to compute surface area.

$$\frac{P}{W(P_0-P)} = \frac{1}{CW_m}\frac{C-1}{CW_m}\frac{P}{P_0}$$

W = amount of adsorbed gas
Wm = amount of gas adsorbed in a monolayer
P = gas pressure
P_0= equilibrium (saturation) vapor pressure at the test temperature
C = dimensionless constant that depends on the temperature and the gas/solid system

When vapor pressure, P is low compared with P_0 ($0.05 < P/P_0 < 0.3$), the plot of $[P/W (P_0 – P)]$ verses $[P/P_0]$ is linear and the plot yields the magnitudes of C and W_m. The surface area S per unit mass, m, of the sample is computed using the cross-sectional area of the adsorbed gas molecule:

$$S = \frac{W_m N_o a}{m}$$

Where:
N_0 = Avogadro's number
a = cross – sectional area of the adsorbed gas molecule
W_m = amount of gas adsorbed in moles

Analytical Techniques

Adsorption / desorption isotherm.
Specific surface area by BET method or Langmuir method.
PCT curve
BJH/CIIDH/INNES Method (Mesopore distribution)
Alpha s Plot
t plot
MP method,
Horvath- Kawazoe method
Saito-Foley Method
Dubnin-Ashtakov method.
evaluation methods using GCMC and NLDFT

Specifications*

Sample P/Po range (10^{-8}- to 0.999)

Specific surface area: 0.01 m^2 g or better with N2 at 77K or Ar at 87K and 0.0005 m^2g or better with Kr at 77K

Pore size distribution: 0.35 - 400nm (diameter) or better

At least two pressure transducers for each sample station with different ranges (e..g., 0.1 torr to 1000 torr) should be available for better accuracy and to ensure simultaneous and independent monitoring of sorption behaviour and equilibrium pressures. Accuracy of each transducer should be ± 0.2 % or better.

Measurement of saturation vapor uses a dedicated port for pressure measurement of saturation vapor pressure with a dedicated pressure sensor

Valves: pneumatic valves / magna latch valves.

Measurement program: Automatic adsorption / desorption isotherm measurement

Three certified reference standards are included for performance evaluation of adsorption

Power:AC 200-240V, 60 Hz

P/P_0 range: $< 1 \times 10^{-8}$ to > 0.999

Temperature accuracy: ± 1 % of set-point or better

Vacuum degassing achievable: 8×10-10 mbar or better.

**Other specifications for this machine are available. Specifications are subject to change without notice.*

Features

- Double-wall Liquid N2 Dewar, holder and other accessories such as coolant level controller for analysis. Dewar must allow minimum 90 hours of operation without refill.

- Suitable sample preparation(vacuum degassing) ports (minimum two) with provision to heat the samples up to 350 °C or higher (Temperature accuracy ±1 %) prior to analysis. Programmable ramp/hold test protocols should be available. Degassing ports should be equipped with dual-thermocouple heating mantles and over temperature protection. Temperature resolution should be 1 °C or better for control of temperature during experiments.

- Gas / vapor adsorption-desorption isotherm measurement option with non-corrosive gases. The unit should be available with up to twelve gas input ports (in addition to helium and backfill gas) for use with physisorption measurements to eliminate connecting/disconnecting gases for demanding applications and/or multi-user environments

- All valves is electric/pneumatic controlled. Automated software for control of the instrument and Data acquisition

- All utility connections for the gas lines is made of leak proof compression fittings

- Double-wall dewar, holder and water level sensor and imported chiller for use with vapor and for CO2 applications should be included

- Fully integrated, vapor introduction system shall be available wherein the vapor source is housed within the manifold housing to ensure equal thermal conditions of the two, up to 50°C.

- Analysis software with provision to calculate surface area by BET, Langmuir, BJH, DFT etc., micropore analysis using NLDFT, Monte Carlo, t-plot etc., and mesopore analysis using NLDFT, BJH etc.

- Printer: Compatible high end and branded colour Laser Printer

- The unit should have facility upgrade for Chemisorption and TCD (For TPD/TPR/TPO studies)

- Instrument should have provision to connect mass spectrometer

- Instrument should be supplied with all accessories and consumables from manufacturer(e.g. sample cell available in different sizes for powder, pellets, and cores(10 no. for each size), filler rod(10 no. each), O-rings, flanges, reference cell(2 no. each min), surface area reference materials etc.) to run for at least five years

Adsorption gas

Uses a wide variety of adsorptive gases like N2, Ar, Kr, as well as non corrosive gases like H2, O2, CO2, CO,CH4, NH3 etc as well as alcohol, benzene and other VOC vapor adsorption apart from water vapor adsorption

Accessories

- Four Dewar flasks, 3 different type sample cells and 2 sets of glass rods
- Includes five sets of consumables and small accessories.
- Sample preparation unit uses heat and vacuum degassing with a maximum temperature 435 deg C, and can prepare at least 3 samples simultaneously.
- Utility gas cylinders [He(Capacity 47 L), N2(Capacity 47 L), H2 (Capacity 47 L)] and CO2 gas(Capacity 47 L) with purity >99.999%) with two-stage pressure regulators with high pressure cable etc. should be included
- Liquid N2 container 5 L, 20 L and 50 L should be included with trolley/transfer device
- Computer: Processor- Intel core i5 or better, Hard Disk: 500 GB min, RAM: 8GB, OS: Windows 7 with suitable USB(min no. 4), LAN ports and suitable LCD monitor for control and data acquisition
- Printer: Compatible high end and branded colour Laser Printer
- A high-end balance(with accuracy of 0.0001 g) of reputed company with balance cover and anti-static resistance should be included
- UPS 5kVA 30min back up(Make such APC, Numeric, Uniline)

Sales & Services

Our sales team is dedicated to helping our customers find which machine is right for their situation. We also offer custom machines for customers with unique needs. To find out what we can do for you, contact us.

We are committed to customer support including specific service products, short response times & customer specific solutions. To quickly & flexibly meet our customer's requirement, we offer a comprehensive range of services.

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