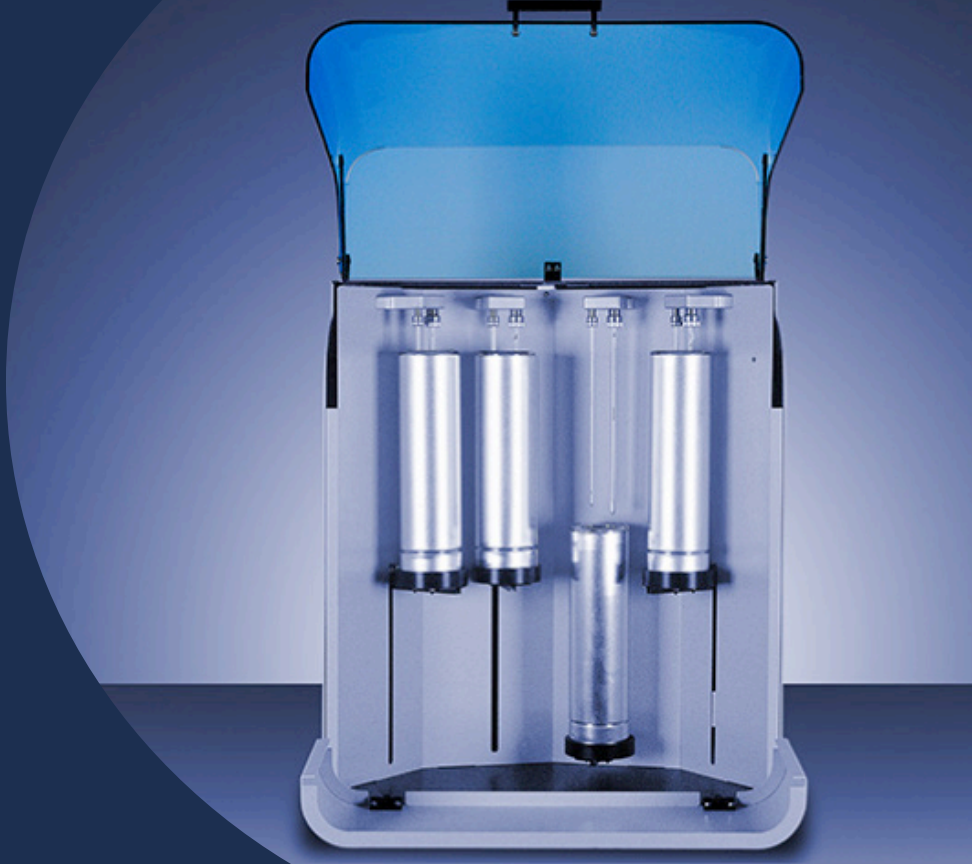
MANCHESTER 1824
The University of Manchester

QUANTACHROME INSTRUMENTS QUADRASORB EVO SURFACE AREA & PORE SIZE ANALYSER (B.E.T. THEORY)



Quadrasorb EVO Surface Area & Pore Size Analyser provides fast and accurate B.E.T. (Brunauer, Emmett and Teller) surface area measurements, by characterising the porous structure of materials, and providing the specific surface area (SSA), specific porous volume (SPV), and pore size distribution (PSD) of a sample.

The volume of gas adsorbed to the surface of the particles is measured at the boiling point of nitrogen (-196°C). This sorptive gas is correlated to the total surface area of the particles, including pores in the surface. From here, calculations are based on the B.E.T. theory. Basic concept of adsorption/desorption analysis is to investigate the relationships between the quantity of gas molecules physically absorbed onto a solid surface and the resulting gas pressure change.

Before performing experiments, solid surfaces must be freed from contaminants such as waters and oils. Surface cleaning (degassing) is carried out prior by placing a solid sample in a glass cell and heating it under vacuum. Once "clean", the sorbent sample is placed within the instrument, where a known quantity of sorptive gas (e.g. nitrogen) is dosed into the vessel. Small amounts of gas (absorbate) are admitted in steps into the evacuated sample chamber. Gas molecules that stick to the surface of the solid sample are adsorbed, forming a thin layer that covers the entire adsorbent surface.

Using the Brunauer, Emmett and Teller (B.E.T.) theory, the user can estimate the number of molecules required to cover the adsorbent surface with a monolayer of adsorbed molecules.

Continued addition of gas molecules, beyond monolayer formation, leads to the gradual stacking of multiple layers (dosing). As the gas pressure approaches saturation, the pores largely completely fill with the adsorbate. Knowing the density of the adsorbate, the user can calculate the volume and the total pore volume of the sample.

After, the user can reverse the adsorption process by withdrawing known amounts of gas from the system in steps – resulting in desorption isotherms to generate. The result leads to isotherm shapes that can be mechanistically related to those expected from particular pore-shapes.

BET Analysis is an easy and non-destructive method for surface area and pore size analysis of samples. Using four simultaneous and independent analysis ports, each dewar systems allows separate samples to be started as soon as previous measurements are completed. Using QuadraWin software it guides the user through analysis set up, data reduction, graphs and reporting. During operation, users can view accumulated data, isotherms and all associated graphs and analytical results up to that point.

Analysis Specifications:

- Surface Area Range from 0.01 m2/g to no known upper limit (nitrogen)
- Pore Size Range 0.35 – 400 nm
- Minimum P/PO (N2) is 1 x 10-3

Quadrasorb EVO is fitted with:

- Four sample ports analysers including separate and independent Dewars, 1000 torr pressure sensor and PO cell
- Each analysis port can be independently programmed with different analyse and measurement conditions/parameters.
- Multiple gas dosing methods to optimise analysis time and resolution
- Range of Adsorbate gases available. Traditionally, nitrogen is used or any other non-corrosive gas with appropriate coolant.

Data Presentation Includes:

- Adsorption and desorption Isotherms
- Multi and single point BET surface area
- Mesopore Size Distributions
- Total Pore Volume and Average Pore Size