GAS SORPTION TECHNOLOGY

Quantachrome INSTRUMENTS

Analyzer for Characterizing Porous Materials and Gas/Vapor Sorption in General

State-of-the-art manometric/flow sorption analyzer incorporates enhanced vacuum technology with high-sensitivity pressure measurement, automated gas controls, programmable heating and multiple-gas detection systems. The driving force for such hybrid analytical techniques comes from the burgeoning field of materials science.

Nanostructured materials are not a recent phenomenon, just the new varieties and applications for them. For example, carbon black is a nanostructured material and has been manufactured for a very long time. Microporous adsorbents like zeolites and activated carbon are in everyday use. But now, these well-established performance materials are finding themselves in new cutting-edge technologies like fuel cell development. And new materials like carbon nanotubes and metal-organic-frameworks are challenging the old, and challenging established laboratory techniques. Therefore established technologies for characterizing nanoparticulate and nanoporous materials similarly need to adapt.

Quantachrome's Autosorb-iQ represents the latest generation in a much-lauded line of surface area and pore size analyzers. Physisorption and chemisorption capabilities are combined in a single instrument. Most importantly, this unit offers both static, volumetric (manometric) method of measurement, and flowing techniques. This capability is uniquely expressed in the Autosorb's ability to measure sorption isotherms from pressures as low as $1x10^{-7}$ atm, and to perform dynamic heating experiments under flow conditions such as temperature programmed desorption.

High Vacuum

Low background (starting) pressure is essential for detailed sub-nanopore (micropore) analysis. The resulting low level of background contaminating gases now permits highest quality chemisorption measurements. This advancement has been made possible by patented technology which combines the high ultimate vacuum of a turbo-molecular drag pump with a hydrocarbon-free (oil-free) dry diaphragm pump.

Automatic Gas Switching

Microprocessor control automatically executes swap-over routine to ensure clean switching (no mixing) and enhanced safety. The absence of user intervention allows completely unattended operation for complex protocols, resulting in maximum research benefit for minimum operator time.

Linear Heating with In-Situ Temperature Monitoring

Full PID control up to 1100^{o} C generates reliable and reproducible data for temperature programmed studies. This creates the ability to determine vapor bonding strength, acid-site strength, redox cycles, differentiation of carbon allotropes, activation energies, and heats of adsorption.

Cryogen Level Control

A significant amount of background (void) gas in sample chamber (for physisorption under cryogenic conditions) is eliminated by careful control of "cold-zone" using an extremely sensitive RTD level sensor. Volume fillers inside the sample cell further minimize thermal effects.

High Vacuum Degassing

The patented oil-free vacuum system (turbomolecular drag pump and dry diaphragm pump) provide a much improved ultimate vacuum level necessary for enhanced sample preparation. The most exacting, cutting-edge applications demand superior vacuum performance.

Vapor Sorption Capability

Investigation of polar, non-polar interactions at e.g. carbon surfaces often requires the use of organic solvents as adsorbate. Therefore a specially designed built-in module with heated transfer lines has been created to maximize transfer rate and equilibration to minimize analysis time.

Species-sensitive gas detector

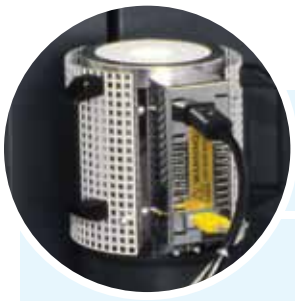
Total integration of technologies makes it possible to use a built-in Quadrupole Mass-spectrometer without requiring an external vacuum system. The positive identification of multiple events during a heating profile is used to study catalyzed reactions on the sample surface. This is now done with effectively no increase in footprint (bench space) over the base unit.

Rapid titration under flow conditions.

A thermal-conductivity detector - a budget conscious alternative to mass-spectrometry - is ideal for measuring strong gas interaction with surface for active area and metal dispersion values. In combination with linear heating, this hybrid quickly and automatically generates temperature dependent reduction and oxidation profiles.

The Future of Materials Characterization

The Autosorb-iQ suite of technologies has already been adopted by cutting-edge materials research groups in industry and academia. It is providing them with unparalleled flexibility for nano-scale characterization and is backed by the latest software models for nanoporous solids. For a complete description of this technology and to discuss how it meets your needs for nanoscale characterization, email ***qc.support@quantachrome.com.***



Autosorb®-iQ-C

Chemisorption and physisorption capabilities combined in a single instrument. Fully automated in-situ treatment of sample includes computer controlled gas switching between multiple gas inputs. User-programmable automatic protocols combine treatment and analysis. Chemisorption isotherms yield metal area, dispersion, nanocluster size and spillover. Detailed calculation and reporting software are included for comprehensive catalyst characterization.

Autosorb-iQ for TPX

Enhanced model for temperature programmed studies: reduction (TPR), oxidation (TPO) and desorption (TPD). Uses highly sensitive yet cost effective detector (TCD). Automatic protocols generate TP profiles for reaction thermodynamics. Includes pulse-titration feature for rapid metal area, dispersion, and nanocluster size determination. Optional built-in mass-spec available.

Autosorb-iQ

New cryostat for gas sorption studies at any temperature between 77 K and 200 K (-320°F and -100°F) using only liquid nitrogen as a cryogen, with a 24-hour hold time to enable round-the-clock experiments

Autosorb-iQ, vapor option

Upgraded system features effective built-in vapor introduction system. Thermostatted heating prevents condensation of vapors. Available on all chemisorption models. Vapor-equipped units retain all cryogenic physisorption and high temperature chemisorption functionality.

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