3FLEX

Surface Characterization

micromeritics®

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A new advanced dosing method that allows you to mix both pressure and volume increments

Advanced manifold design and embedded control provide an ultra-stable environment for pressure and temperature measurements, extending the limits of resolution

The 3Flex™

Surface Characterization Analyzer

A fully automated, three-station instrument designed for a variety of analyses with superior accuracy, resolution, and data reduction:

- Surface area
- Mesopore
- Micropore
- Chemical adsorption (chemisorption)
- Heat of adsorption
- Vapor

Advancements in Performance and Technology

- Three configurable analysis ports adapt to the specific needs of your workflow
- Research-grade instrument provides superior mesopore/micropore, physisorption, or chemisorption analyses. Ports can be configured for krypton analysis of low surface area materials
- Vapor sorption capability
- Ultra-clean manifold design features hard-seal valves and metal seals to provide high chemical resistivity, ease of evacuation, and lowest outgasing rate in the industry
- P_0 port with dedicated pressure transducer allows continuous monitoring of saturation pressure
- Isotherm data collection begins in the 10^{-6} torr range (10^{-9} relative pressure range for N_2)
- MicroActive™ Data Reduction software provides powerful, yet intuitive, data analysis with preconfigured or user-defined reporting options
- Advanced dosing method permits user to combine pressure and volume increments
- Small footprint conserves valuable lab bench space

High-Resolution, Improved-Throughput Micropore Analyses

The 3Flex is capable of analyzing three samples in parallel so that three complete isotherms are collected in the time usually required for one analysis. Each of the 3Flex analysis ports is capable of achieving very low absolute pressures as a result of the design and construction of the manifold and its connection to a high-vacuum system. Since smaller pore sizes are measured at lower relative pressures, micropore data are more accurately measured.

The 3Flex is ideally suited for the characterization of MOFs, zeolites, activated carbons, adsorbents, and a wide variety of porous and non-porous materials.

Major Design Features

3Flex Features	Design Benefits	Discussion
316 SS fittings and pneumatically actuated, hard-seal valves	Provides virtually leak-free gas management with the lowest outgassing rate in the industry. Fast changeover from vapor to gas analysis	Improving gas management control provides increased accuracy and superior sensitivity, extending the range of critical micropore analyses
A single instrument with three configurable analysis ports for high-resolution mesopore, micropore, and chemisorption analyses	Eliminates the need for multiple instruments to meet your research needs and workflow requirements	Superior return on investment - a single instrument, fully configurable with the flexibility to extend or expand capabilities in the future
Stainless-steel gas inlets, manifold, valving, and gaskets	Highly clean and chemically resistive surfaces provide a non-contaminating analytical environment	Eliminates interference from contaminants and outgassing associated with elastomer seals and O-rings. Highly resistive surfaces permit greater flexibility in choice of adsorptive gases or vapors
Continuous monitoring of critical system component performance	Unique dashboard view advises user of all critical system components' performance during analysis for secured results	Increase the confidence in your results by confirming critical system components performance during a run
Extended applications and convenience through optional accessories	Optional accessories include: • Heated Vapor Option • Research-grade cryostat (20K) • Chiller-dewar with recirculating bath • Mass Spectrometer	Extend the analytical range or add efficiency with the convenience of consistent temperature control without the use of a cryogen

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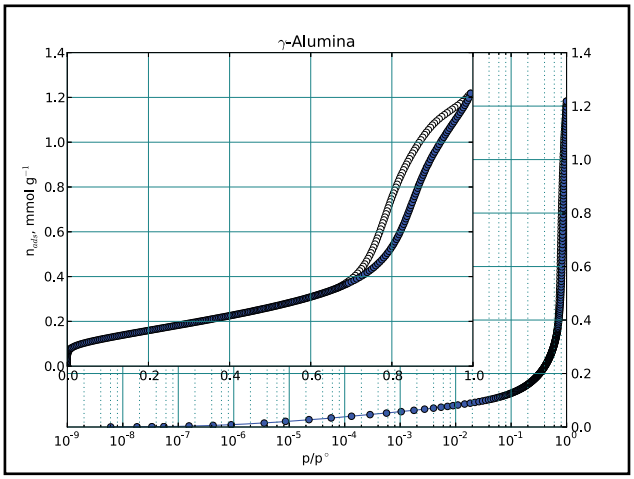
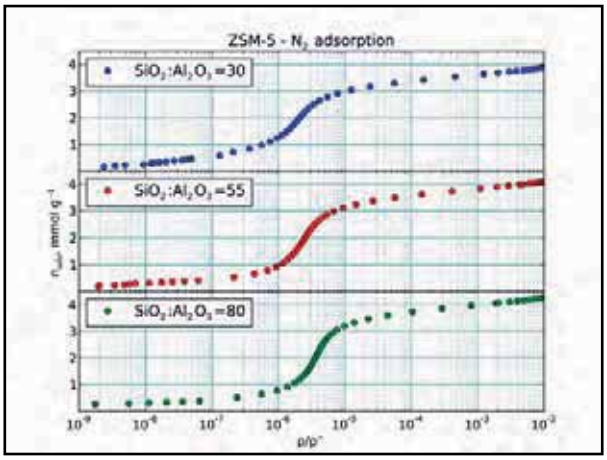
High-Resolution Isotherms

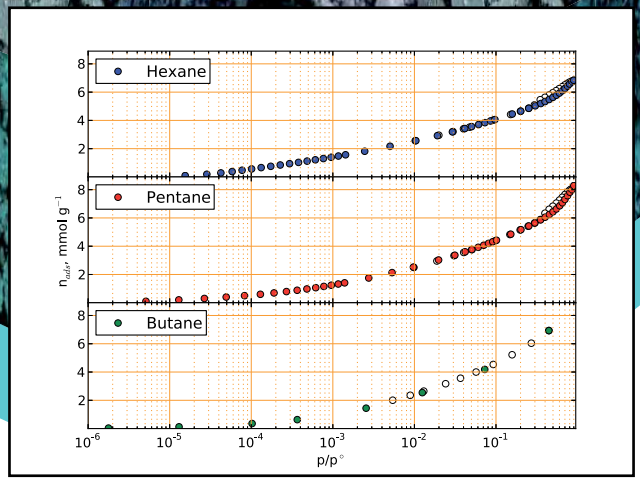
The new manifold design and embedded control provides an ultra-stable environment for pressure and temperature measurements. In addition to hardware advancements, **the 3Flex contains several software advancements including a new advanced dosing method that allows you to mix both pressure and volume increments.**



Nitrogen adsorption isotherm for γ-Alumina



Nitrogen adsorption isotherm for ZSM-5



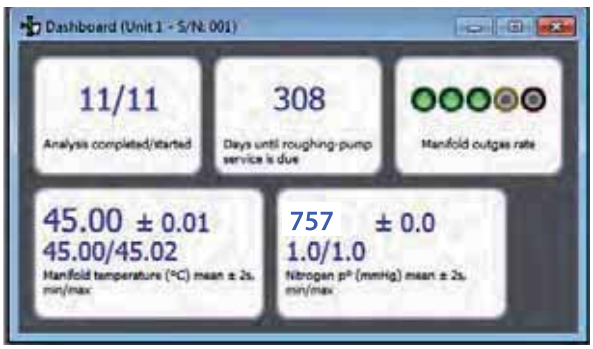
Butane, pentane, and hexane adsorption isotherms for a pelletized activated carbon

Vapor Isotherms

The 3Flex includes an extensive library of fluid properties of fixed gases and commonly used vapors. Isotherm data are easily collected using hydrocarbons as the adsorptive.

Innovative Dashboard

With a single click, the 3Flex provides a powerful suite of information that allows you to maintain the instrument in peak operating condition with real-time analysis views.



Specification	3Flex Instrument Specifications	3Flex Analysis Performance Specifications	Discussion
Sample Analysis Ports	3 ports	1, 2, or 3 micropore-capable ports	Mesopore to micropore and chemisorption capability - ability to upgrade mesopore ports to micropore in the future
Vacuum System	Turbo molecular drag pump in series with hybrid-turbo diaphragm pump		Two pumps ensure a superior high-vacuum system - one to pull pressure down to a level where the turbo molecular drag pump provides additional performance
Pumping Speed	53 L/sec (hydrogen) 61 L/sec (nitrogen)	53 L/sec (hydrogen) 61 L/sec (nitrogen)	High pumping speed is essential to permit fast and clean evacuation
Ultimate Vacuum	3.75×10^{-10} mmHg	8.0×10^{-6} mmHg (at sample port)	Determines the quality and speed of analysis - critical specification is the vacuum produced at the sample port, not just the rating of the vacuum system
Vacuum Gauge	Dual Cold Cathode/ microPirani gauge	Gauge placed in close proximity to sample port	For proper monitoring, the gauge must be placed close to the sample port. Measuring vacuum at the pump is not indicative of pressure at the sample. The 3Flex design permits automatic zeroing, ensuring greater accuracy and repeatability
Minimum Measureable Surface Area	0.01 m^2/g	0.0005 m^2/g (krypton)	Standard krypton capability permits very low surface area material to be accurately analyzed
Transducers	1000 mmHg, ± 0.12% of reading 10 mmHg, ± 0.12% of reading 0.1 mmHg, ± 0.15% of reading	10 mmHg, ± 0.12% of reading accuracy display resolution 10^{-4} mmHg 0.1 mmHg, ± 0.15% of reading accuracy display resolution 10^{-6} mmHg	Percent of actual reading is more accurate than percent of full scale deflection Due to our proprietary temperature control, the actual analysis performance of the transducer has demonstrated better accuracy than the manufacturer specification
Adsorptive Gas Inputs	6	Expandable to 12	Expandable versatility extends adsorptive gas range investigation to extend the range of application
Degas	3 *in situ*, 6 additional with each optional Smart VacPrep	Ambient to 450 °C, programmable - 5 heating and 5 soak periods	Helium free space can be performed after analysis to prevent helium entrapment
Dewar	3.2 L capacity, >80 hrs (single tube, no isothermal jacket)	>70 hrs (3 sample tubes, isothermal jackets, P_0 tube)	Redesigned dewar can provide analysis time greater than listed specification with a unique design that permits refilling without interrupting the analysis
Control of Cryogen Level on Sample Tube	Isothermal jacket		Assures a constant thermal profile along the length of both the sample and P_0 tubes throughout the extended analysis. Maintains constant free space for the best analysis of mesopores
Sample Tubes	Metric, flat bottom, 9 and 12 mm		Tubes are clearly marked for diameter and feature a convenient ID location

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Innovative Instrument Diagnostics

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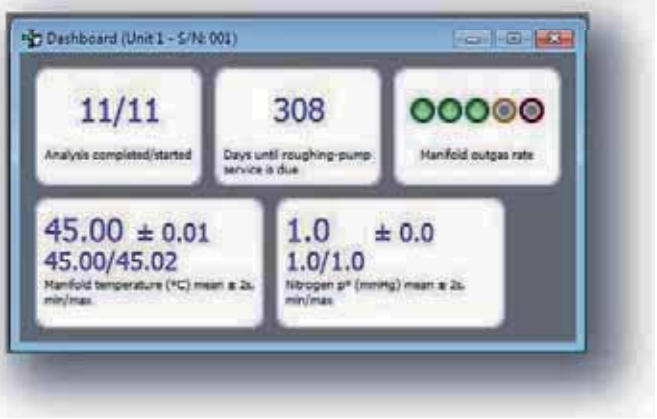

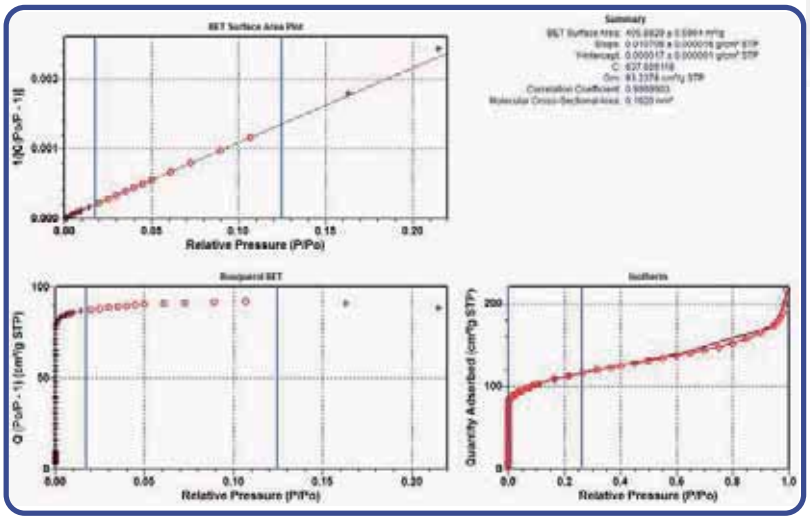

MICRO ACTIVE

MicroActive for 3Flex

Interactive data manipulation permits user to accurately and precisely determine surface area and porosity. User selectable data ranges through the graphic interface allows direct data modeling for BET, t-plot, Langmuir, and DFT interpretation, minimizing time to results.

Specifications

Physical	*Height:*	44 in. (111.76 cm)
	Width:	22.5 in. (57.15 cm)
	Depth:	24 in. (60.96 cm)
	Weight:	185 lbs. (83.91 kg)
Power Consumption	*Voltage:*	100/115/230 VAC
	Frequency:	50 or 60 Hz
	Power:	1500 VA, maximum
Operating Conditions	*Temperature :*	10 to 35 °C (50 to 95 °F) operating
		0 to 50 °C (32 to 122 °F) non-operating
	Humidity:	20% to 80% relative, non-condensing

HEADQUARTERS
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