MICROMERITICS

PRODUCT BROCHURE

www.micromeritics.com

PHYSISORPTION

Carefully engineered to perform surface area and porosity measurements, the physisorption line of instruments determines the quality and utility of a wide range of materials. Though different materials can appear to be identical, variations in the surface area and porosity can greatly influence the material's performance characteristics. Micromeritics offers a large selection of gas sorption analyzers that will fulfill demanding requirements for determining surface area and porosity.

	Sample Ports	Pore Size Range	Low Surface Area Measurement
3Flex	3	micro meso	✓
ASAP 2020	1	micro meso	✓
TriStar II	3	micro* meso	✓
Gemini VII	1	micro* meso	✓
ASAP 2420	6	micro meso	✓

* Micropore analysis can be performed on the TriStar II and Gemini VII with the use of CO_2

3Flex™

The 3Flex is a fully automated, three-station instrument capable of high-throughput surface area, mesopore, and micropore analyses with superior accuracy, resolution, and data reduction and reporting versatility. Each analysis station is upgradeable from mesopore to micropore with its own set of pressure transducers.

- Three independently configurable analysis stations
- Micropore stations include krypton capability for low surface area materials – vapor is standard and an extended-range vapor option is available
- Ultra-clean, leak-free operation with pneumatically actuated, hard seal valves
- Interactively evaluate isotherm data with MicroActive software and user-defined reporting options – reduces time required to obtain surface area and porosity results
- Innovative dashboard monitors and provides convenient access to real-time performance indicators and maintenance scheduling information

ASAP® 2020

The ASAP 2020 can obtain high-quality data for research and quality control applications and is designed to provide surface area, porosity, and chemical adsorption data to materials analysis laboratories. The standard model can be upgraded to perform a full range of surface characterization analyses.

- Surface area, porosity, chemisorption, and sample preparation capability are integrated into a single cabinet
- Optional micropore system delivers porosity data with a comprehensive selection of reports for determining pore size and volume distributions
- The HighVac option provides the low-pressure capability and pressure measurement resolution required for low surface area analyses
- Water Vapor Adsorption and Enhanced Chemical Resistance options are available
- Onboard two-station sample preparation system provides automatic control for degassing samples

TriStar® II

The TriStar II is an automated, three-station, surface area and porosity analyzer capable of increasing the speed of quality control analyses with the accuracy, resolution, and data reduction features to meet most research requirements.

Simultaneous and independent analysis of up to three samples – four TriStars can be operated from a single computer.

- Three analysis stations operate simultaneously and independently of one another
- The standard nitrogen system can also accommodate the use of argon, carbon dioxide, and other non-corrosive gases. A krypton option allows measurements in the very low surface area range
- A dedicated P_0 port with transducer is standard, allowing the measurement of saturation pressure on a continuous basis. Saturation pressure can be entered manually, measured continuously, or collected over the sample
- Free space can be measured, calculated, or manually entered

Gemini® VII 2390 Series

The Gemini VII 2390 Series surface area analyzers utilize a reference-sample tube design to produce accurate and repeatable surface area and porosity results. Their low cost, small footprint, speed, accuracy, simplicity of use, reliability, and ruggedness make the Gemini Series an ideal tool for teaching, research, and quality control environments. The Gemini VII Series permits low to high surface area measurements without requiring the use of krypton.

Three options are available:

Gemini VII 2390a

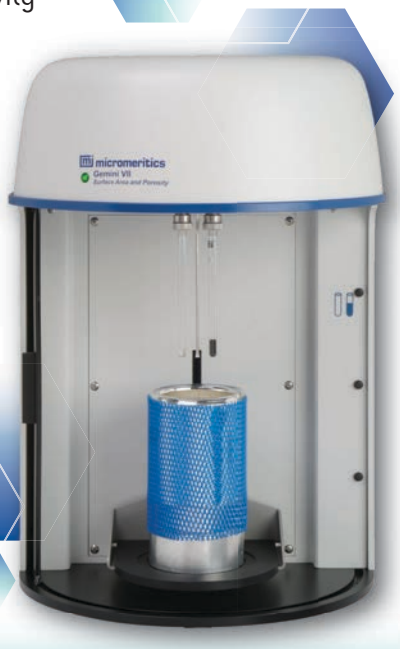
- Surface area determinations by single-point and multipoint BET, and by Langmuir methods
- Standard methods for total pore volume, micropore analysis by t-plot, and much more
- Differential adsorption measurement permits the greatest measurement sensitivity
- Can determine statistical thickness surface area (STSA) of carbon blacks

Gemini VII 2390p

- The same features as the 2390a with the addition of a saturation pressure (P_0) tube
- Permits a rapid measurement of the adsorption isotherm to near saturation, allowing BJH pore size distribution to be determined

Gemini VII 2390t

- All the features of the 2390p, including a P_0 tube, with the addition of a larger Dewar and longer sample tubes for extended analyses
- Capability to measure the total adsorption-desorption process without refilling the Dewar



ASAP® 2420

The ASAP 2420 system is designed for high-performance/high sample throughput. With six independently operated analysis stations, a new analysis can begin as soon as another is finished.

- Six independently operated analysis stations
- Programmable and fully automated sample preparation module with twelve independently operated stations
- A low surface area option using krypton as an adsorptive can measure total surface areas
- With low-pressure dosing and equilibration modes, a micropore option allows micropore analyses to be performed concurrently on all six independently operated analysis stations

CHEMISORPTION

Chemical adsorption analysis techniques provide much of the information necessary (such as percent metal dispersion, active metal surface area, and active crystallite size) to evaluate today's catalytic materials in the research, development, and production phases, as well as after-use evaluation.

	Analysis Ports	Analyses	Mass Spec Intergration
AutoChem II		TP ASA AC	✓
ChemiSorb Series	+	TP ASA AC	✓
ASAP 2020 Chemi		ASA	✓
ChemiSorb HTP		ASA	

** TP = Temperature-Programmed Analyses, ASA = Active Metal Surface Area, AC = Acidity

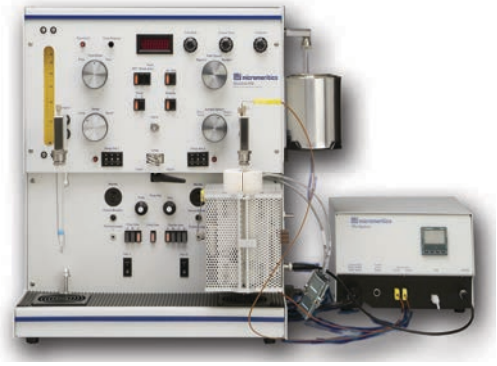
AutoChem® II

The AutoChem II performs a full array of highly precise, temperature-programmed studies. It uses the dynamic (flowing gas) technique to perform pulse chemisorption and temperature-programmed methods – reduction (TPR), desorption (TPD), oxidation (TPO), and reactions (TPSR) – as well as BET surface area evaluation.

- CryoCooler II option allows analysis temperatures as low as -100 °C
- Optional Vapor Generator allows analysis using vapors in an inert carrier stream
- Includes an integrated mass spectrometer port – an optional mass spectrometer is available
- Integrated peak editing and data reduction software

ChemiSorb™ Series

The ChemiSorb 2720 and 2750 utilize the dynamic (flowing gas) technique to study physical or chemical adsorption. The ChemiSorb is an affordable option for those who require both chemisorption and physisorption analyses.



ChemiSorb 2720 – Dual station, one for analysis and one for sample preparation

ChemiSorb 2750 – Dual-function sample station can be used as either a sample station or degas station, permitting *in situ* sample preparation. Three built-in preparation gas inlets and four carrier gas inlets allow for a variety of experiments without having to disconnect, reconnect, and purge gas lines

- Optional access fitting allows the ChemiSorb to utilize a mass spectrometer or other external detector
- The optional ChemiSoft™ TPx System (temperature-programmed controller and software) expands the capability of the series to include: multipoint BET surface area, temperature-programmed reactions, data archiving, and advanced data reduction and reporting options

PARTICLE SIZE

The selection of a particle size instrument depends on: the physical and chemical properties of the materials, size range, throughput requirements, resolution, precision, and the instrument operation environment. Micromeritics offers an extensive line of particle size analyzers based on a variety of measurement techniques because no single particle sizing technique is ideal for all materials and applications.

	Technique	Particle Size Range	Application	
Saturn DigiSizer II	CCD/Digital Laser	40 nm ⟷ 2500 µm	Inorganic ✓	Organic ✓
SediGraph III	X-Ray Sedimentation	100 nm ⟷ 300 µm	Inorganic ✓	Organic
Elzone II	Electrical Sensing Zone	400 nm ⟷ 240 µm	Inorganic ✓	Organic ✓

Saturn DigiSizer® II

The Saturn DigiSizer II is a state-of-the-art laser particle size analyzer that utilizes advanced optics, CCD technology, and over three million detector elements to deliver a high-resolution measurement of articulations in the scattering pattern. This allows a high degree of size discrimination or resolution. Higher size resolution reveals information about the material that goes undetected with other laser particle sizing systems, providing more accurate results.

- Range of 40 nanometers to 2.5 millimeters
- Fast, detailed results that are repeatable and reproducible between every Saturn DigiSizer
- Liquid sample handling unit available in both standard and low-volume configurations for automatic sampling, diluting, and dispersion
- Optional MasterTech 052 autosampler provides unattended analysis of up to 18 samples

SediGraph® III

The SediGraph III analyzer combines the proven SediGraph analytical technique with advanced instrumentation features to provide superior repeatability, accuracy, and reproducibility. The SediGraph III uses x-ray absorption to measure mass concentration and Stokes' Law to determine particle size.

- Range of 0.1 to 300 μm
- Complete sample mass accountability – accounts for material outside the measurement range
- Direct measurement of mass fraction
- Reports mass distribution by particle size and settling velocity
- Correlates well to classical sedimentation methods
- Optional MasterTech 052 autosampler provides unattended analysis of up to 18 samples

Elzone® II

The Elzone II utilizes the electrical sensing zone technique to size and count particles. Particle-by-particle sizing techniques, such as electrical sensing zone, provide the highest resolution available. The Elzone II can size samples that have assorted optical properties, densities, colors, and shapes. It can determine the size, number, and concentration of a wide variety of organic and inorganic materials.

- Sizes and counts both organic and inorganic materials down to 0.4 μm
- Does not require previous knowledge of material properties (density, refractive index)
- Single-particle measurement permits the discovery of low numbers of particles (outliers) larger than the main population
- Automated features include: start-up, run, and shut-down routines; blockage detection and clearing; flushing/rinsing; and calibration

MERCURY INTRUSION POROSIMETRY

	Sample Ports	Pore Size Range	Pressure Configuration	
AutoPore IV Series		meso — macro	Low 2-4	High 1-2

AutoPore® IV Series

The AutoPore IV series uses mercury intrusion and extrusion to determine total pore volume, pore size distribution, percent porosity, density, compaction/compression and fluid transport properties.

- Available with two low-pressure ports and one high-pressure port or four low-pressure ports and two high-pressure ports for increased sample throughput
- Enhanced data reduction package includes tortuosity, permeability, compressibility, pore-throat ratio, fractal dimension, Mayer-Stowe particle size distribution, and more
- Operates in scanning, rate-of-intrusion equilibration, or time equilibration modes
- Collects extremely high-resolution data; better than 0.1 µL for mercury intrusion and extrusion volumes
- Enclosed mercury system to prevent mercury exposure to the environment – low-volume mercury usage
- Optional Mercury QuikVac accessory to aspirate, capture, and safely contain small droplets

DENSITY

Density is defined as the ratio of mass to volume. This measurement is important to many industry applications. Micromeritics pycnometers are used worldwide to measure volume and determine material density of powders and solids.

	Analysis	Technique
AccuPyc II	True	Helium Displacement
GeoPyc	Envelope	Quasi-Fluid Displacement
DVVA II	Dynamic	Compressed Void Volume

AccuPyc® II

The AccuPyc II is a fully automatic helium displacement pycnometer that produces high-speed, high-precision volume measurements and density determinations of powders, solids, and slurries having volumes of 0.01 to 350 cm^3. Helium pycnometry is recognized as one of the most reliable techniques for obtaining skeletal volume and density.

- Capable of measuring volume (and therefore density) to four decimal places
- Integrated control and analysis module can operate up to five additional external analysis modules
- Custom-sized modules can be configured to suit unique applications
- MultiVolume Option allows analyses of a variety of sample sizes in one analysis module
- Temperature-controlled version allows measurement at user-selectable temperatures

GeoPyc®

The GeoPyc utilizes a quasi-fluid displacement medium composed of non-hazardous microspheres having a high degree of flowability that do not wet the sample or fill its pores.

- Determines envelope volume and density of monolithic samples as well as the bulk volume and density of powdered materials
- A variety of sample chambers is available to accommodate a wide range of sample sizes
- T.A.P. Density option – measures the packing volume and calculates the bulk density of granular and powdered samples

DVVA® II

The DVVA II measures the dynamic void volume of carbon black and other materials. The void volume is measured by compressing the sample at user-specified pressures.

- Meets all requirements of the ASTM D 6086 standard, with two independent load cells
- Constant Ramp Scan offers fast measurement of compression data across a range and allows selectable scan rates to be applied to pressures up to 230 MPa

Custom-Engineered Products

If your work requires an analytical device, technique, or instrument configuration that is not commercially available, talk to us. Micromeritics has a team of scientists and engineers from a wide array of disciplines: electrical, mechanical, software, and chemical engineers; chemists and physicists.

Typical customer requests:

- Special data reduction and reporting software
- Enhanced detection sensitivity
- Ability to accommodate samples of unusual shapes and sizes
- Capability to withstand corrosive materials or safely accommodate hazardous ones
- Designing and building a one-of-a-kind instrument for performing uncommon analyses or analyses required by an emerging industry

To determine if Micromeritics can provide a solution that you are seeking, contact Micromeritics at (770) 662-3636 and ask for our Director of Pioneering or send a message to the email address below.

custom.products@micromeritics.com

Particulate Systems

Micromeritics is dedicated to advancing the science of materials characterization by identifying new innovative instruments for its Particulate Systems brand. Small companies and independent innovators with novel instrument designs benefit from Micromeritics' extensive sales and service network while end users are offered new and exciting technology that otherwise may have remained obscured by more prominent or better-funded manufacturers.

Particulate Systems has increased its instrument portfolio to eleven products. Each of these instruments provides material characterization solutions complementary to Micromeritics' core product line.

- Nano particle size
- Zeta potential
- Particle shape
- High-pressure adsorption isotherms
- Dynamic vapor sorption
- Activity and selectivity of catalysts
- Surface energy
- Segregation testing
- Low levels of iron content in a variety of materials

www.particulatesystems.com

MICROMERITICS ANALYTICAL SERVICES

The Particle Testing Authority

Micromeritics Analytical Services (MAS) provides contract sample analyses based on the following principles: high-quality results, fast turn-around-times, and outstanding customer service. Featuring products manufactured by Micromeritics, MAS also provides additional services outside of Micromeritics' current product line.

Services include:

- Particle Size Distribution
- Particle Shape
- Particulate Count
- Nano Particle Size
- B.E.T. Surface Area
- Micropore Analysis
- Pore Volume Distribution
- Total Pore Volume
- Density
- Surface Energy
- Dynamic Water Vapor Sorption
- TGA
- DSC
- Active Surface Area
- Percent Metal Dispersion
- Crystallite Size
- High-Pressure Adsorption Isotherms
- Magnetic Content
- Zeta Potential
- Isosteric Heat of Adsorption
- Microscopy
- Method Development
- Method Validation
- Consulting Services

All results are thoroughly reviewed by highly qualified scientists and strict confidentiality is maintained at all times.

www.particletesting.com

MICROMERITICS PHARMACEUTICAL SERVICES

MPS is your complete solution for expert particle and powder characterization. We provide clients with essential data and consultation to achieve a comprehensive understanding of material properties during drug discovery and development.

Services include:

- Particle Analysis
- API Characterization
- Excipient Screening
- Vapor Sorption
- Surface Area
- Surface Energy
- Microscopy
- Thermal Analysis
- Powder Flow Properties
- Identification of Critical Quality Attributes
- Batch Variability
- QbD/PAT Implementation
- Consultation
- Analytical Methods Development/Validation

Micromeritics Pharmaceutical Services is a cGMP/GLP laboratory, registered with the FDA, and DEA licensed.

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Micromeritics Training Center

Micromeritics offers basic and advanced training for many of our instruments and applications in the Norcross (Atlanta), Georgia Training Center. With hands-on and classroom training, these courses are essential for laboratory personnel who require in-depth knowledge of their instrument operation and its associated analytical technique. If you supervise people who operate Micromeritics instruments or are an experienced user, these training courses are designed to help you gain more in-depth knowledge. When application needs change or new personnel are added, the quickest and most cost-effective way to make a successful transition is through our training programs. The foundation established by these courses provides a platform on which to build for years to come.

For more information, a course schedule, and reservation information visit:
www.micromeritics.com/Service-Center/Training-Class-List.aspx

Founded in 1962,

Micromeritics is a leading supplier of materials characterization analytical laboratory instrumentation and services. The company manufactures a broad line of automated laboratory instruments that measure physical characteristics of powders and solids for fundamental research, product development, quality assurance and control, production, and process control applications. The combination of our high-quality instrumentation, the expertise of our scientific staff, and superior service and support makes Micromeritics the logical choice for accurate and reliable physical characterization of your materials.

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