THE microReport

micromeritics®
The Science and Technology of Small Particles™

MICROMERITICS INSTRUMENT CORPORATION

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In This Issue

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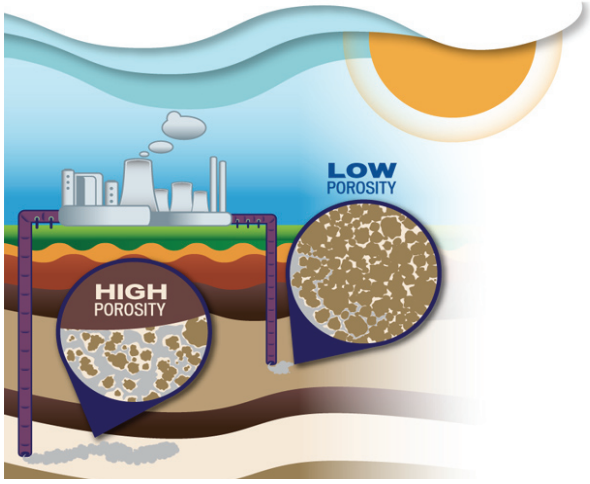
Micromeritics Instruments Aid in Research Aimed at Sequestration of Carbon Dioxide



The combustion of fossil fuels for energy has steadily increased the concentration of greenhouse gases in the earth's atmosphere. Of the numerous trace gases, carbon dioxide is a major component making up the majority of these emissions. Carbon dioxide sequestration involves the capture and secure storage of not only existing amounts of CO_2 in the atmosphere, but emitted CO_2 as well. Since the Kyoto Protocol, concerns over combustion gas emissions have received a great deal of attention.

There are numerous energy-related approaches to managing CO_2 that include several carbon-free energy sources (e.g. nuclear, solar, wind, geothermal, and biomass energy). Scientists are also searching for ways to increase the efficiency of energy conversion so that smaller amounts of fossil fuel energy are required for the same energy output. However, although promising, these alternatives currently have a relatively small effect on current fossil fuel demand and usage. Fossil fuels continue to supply the overwhelming majority of the world's energy consumption. Increasing energy demands, the lag in converting to alternative energy sources, the global economic dependence on fossil fuels, and its relative low cost and high availability mean that fossil fuel consumption will likely continue for decades to come. As a result, there is a considerable amount of scientific research focused on effective methods to remove large amounts of carbon dioxide from the atmosphere and industrial emission sources, and store it safely.

A number of researchers now believe that sequestration of carbon dioxide in deep geological formations shows much promise as a long-term solution for safely storing CO_2 that is captured through cleanup efforts. The basic idea involves compressing captured CO_2 into a dense fluid and injecting it into a porous deep geological formation, where the rising CO_2 fluid is sealed beneath a layer of impermeable cap-rock. Years of experience in the United States with natural gas storage, injecting CO_2 for enhanced oil recovery (EOR), Enhanced Coal Bed Methane recovery (ECBM), and the injection of acid gases into

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saline geological structures have provided an incentive to pursue this promising theory. The U.S. Department of Energy, led by the NETL and Regional Carbon Sequestration Partnerships (RCSP) in partnership with industry and academia, is pursuing a CO_2 Sequestration Research, Development, and Demonstration Program. Field tests are currently taking place throughout the U.S. and Canada. Storage areas being investigated include depleted oil and gas reservoirs, unminable coal seams, and deep saline formations. Many of these formations have contained naturally stored carbon dioxide, other gases, and fluids for millions of years and are believed to have the potential to store many years of human-generated CO_2. In addition, in the last fifteen years, three large-scale CO_2 storage projects in Norway (1996), Canada (2000), and Algeria (2004) have begun operations and reported no safety or health-related incidents.

Even though these formations have the theoretical potential to store human-generated CO_2, it is estimated that annually over a billion metric tons must be sequestered in order to make a significant reduction. Many factors have to be studied prior to determination and full-scale implementation of appropriate sequestration sites. Factors such as proper engineering design, monitoring and hydrologic-geochemical-geomechanical processes that govern the long-term storage of carbon dioxide in the subsurface need to be understood. Research scientists require methods to characterize geological materials that help determine the value of the formation as a reservoir.

Since 1962, Micromeritics has supplied analytical tools that determine porosity and surface area, critical measurements needed for the study of potential CO_2 sequestration sites. Surface area and mercury porosimetry instruments have been used as necessary tools to characterize the sealing and fluid-transport properties of fine-grained sedimentary rocks under the pressure and temperature conditions of geological carbon dioxide. Pore volume measurements help predict the capacity of a formation. Pore size is an important variable in determining the rate at which CO_2 will flow through the formation while filling. Micromeritics' AutoPore® Mercury Porosimeter has been used to determine the sealing capacity and pore-throat aperture size distribution on reservoir core samples. Fluid transport experiments can be complemented by the combination of B.E.T. specific surface area data collected on Micromeritics' ASAP® 2020 Accelerated Surface Area and Porosimetry System and mercury porosimetry data. These experiments help reveal significant changes in the transport properties and sealing efficiency of the samples. The ASAP 2020 is also an ideal tool for measuring both micropore and mesopore distributions in coal, therefore providing valuable information for ECBM studies.

Micromeritics' ASAP 2050 Xtended Pressure Sorption Analyzer and Particulate Systems' HPVA-100 High Pressure Volumetric Analyzer are ideal instruments for evaluating the storage capacity of CO_2 sorbents at high pressures. The ASAP 2050 is a high-resolution instrument that provides capacity as a function of storage pressure for vacuum to 10 bar. The HPVA extends the characterization to 100 or 200 bar. Both the ASAP 2050 and HPVA allow researchers to evaluate materials under real-world conditions.

International governments, with the aid of the scientific community, must find a way to eliminate the excess CO_2 in our atmosphere generated from the burning of fossil fuel. Preliminary data suggest the sequestration of CO_2 in geologic formations presents a promising solution. The goal of storing massive amounts of CO_2 depends partially on a number of physical characteristics needed for research on each of many geological formations. Micromeritics' expertise and its innovative materials characterization instrumentation have already been, and will continue to be, instrumental in providing important measurements required for carbon dioxide sequestration projects.

Micromeritics Mercury QuikVac A Compact, Low-Cost Alternative for Containing Mercury Spills

For many years, mercury has been used in a number of products, processes, and laboratory operations. Mercury is universally regarded as a hazardous material. Health and safety regulations require that anywhere mercury is used, a means of managing spillage and human exposure must be provided.

Micromeritics' Mercury QuikVac is an excellent low-cost method for quickly containing mercury spills. The device is designed to be specifically useful in collecting those elusive mercury droplets and small mercury-contaminated particulate matter. Its compact size and light weight make it ideal for laboratory applications. Mercury is collected in a 250-mL recovery vessel and a replaceable 0.3 – 0.5 micron activated carbon filter assures that the device exhausts clean, safe air.

Micromeritics Introduces its New YouTube Channel

Micromeritics has created a new YouTube channel dedicated to the science of materials characterization. Initially, the company's main focus is to provide a series of educational videos defining various physical characterization techniques for powders and solids. In fact, the channel was recently introduced with a three-part video series covering physical adsorption. Micromeritics will also occasionally post informational videos describing its products and services. Additional material will be developed in response to subscriber comments and suggestions.

In business since 1962, 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. Measurements obtained include particle size, particle shape, surface area, pore volume, pore size and pore size distribution, material density, catalytic activity, and temperature-programmed reactions. Micromeritics markets an auxiliary selection of materials characterization instruments under its Particulate Systems brand. Micromeritics also operates Micromeritics Analytical Services and Micromeritics Pharmaceutical Services, both providing contract sample analyses and consulting services.

The Micromeritics YouTube channel promises to be a useful educational tool for students, educators, lab technicians, scientists, and anyone interested in the science of materials characterization. Visit the Micromeritics YouTube channel at http://www.youtube.com/micromeritics.

While on the channel, click the subscribe button for notification of new postings.

Micromeritics Announces Instrument Grant to the School of Materials Science and Engineering at Georgia Tech

Micromeritics' Grant Selection Committee has selected the recipient of its grant award for the first quarter of 2010. An ASAP 2020 Accelerated Surface Area and Porosimetry System with micropore and rate of adsorption options has been awarded to the School of Materials Science and Engineering at Georgia Institute of Technology, Atlanta, GA.

According to Dr. Gleb Yushin, Principal Investigator, "The School of Materials Science and Engineering is conducting groundbreaking nanomaterials research in a number of areas that include ionic transport in microporous solids, porous electrodes for fuel cells, batteries and supercapacitors, nanomaterials for sensors, porous polymer membranes, gas separation membranes, novel catalysts, nanomaterials for the semiconductor industry, and more. A large portion of samples to be investigated exhibits a high surface area of pores less than two nanometers. The precise knowledge of pore size distribution in the micropore range is crucial for the fundamental studies of ionic and molecular adsorption and transport in the nanoporous solids. Fundamental studies of the transport of ions and gas molecules as well as investigation of materials for catalyst support applications require knowledge about the accessibility of the microporous surface. Studies of the rate of adsorption for gases/vapors of different sizes help to evaluate the interaction of gaseous species with the surface and estimate how tortuous the nanopores are and to what degree the pores have narrow necks. The ASAP 2020 with its micropore and rate of adsorption capabilities will be a critical analytical tool for supporting our research."

According to Preston Hendrix, Micromeritics' president, "This program is designed to promote and advance the acquisition and use of particle characterization instrumentation in non-profit universities and institutions where other means of funding are not generally available. We are very proud and excited to present this award in an ongoing grant program to support important research." Mr. Hendrix has appointed a special Grant Selection Committee to ensure the success and effectiveness of this program.

Micromeritics' Instrument Grant Program is intended to provide particle characterization instruments to non-profit universities and research organizations for the purpose of fostering and supporting meritorious research projects. A maximum of one instrument/integrated system will be awarded per calendar quarter.

Applications may be submitted at any time in accordance with the application instructions and will remain active for a period of one year from the date of submission. Visit http://www.micromeritics.com/Pressroom/Particle-Characterization-Instruments-Grants.aspx for a detailed grant description, application requirements, and application.

MICROMERITICS PHARMACEUTICAL SERVICES

www.micRx.com

Identification of Critical Quality Attributes During Product Development

By: Adam Keith, Business Manager
Micromeritics Pharmaceutical Services*

Researchers and product development scientists alike are learning that timely identification of Critical Quality Attributes (CQAs) enables them to make process and development decisions based on science, not speculation. Historically, hypotheses and/or speculation drove process decisions; however, this methodology by necessity has changed. Gone are the days where trial and error are acceptable in product development. Lean manufacturing, process analytical technology (PAT), and other economic-driven initiatives demand a more intuitive approach from product development programs. Downsizing, dwindling resources, and higher throughput requirements are forcing companies to place greater emphasis on getting it right the first time. The million dollar question becomes: How do we do it?

Quality by Design, or QbD, was pioneered by the automotive industry many years ago. The primary assumption of QbD is that quality can be planned and designed at all stages of process design and development to ensure the finished product is of a high and consistent quality. The intent is that the finished product will require little or no post production testing because the quality was designed into the process. The result is increased productivity, reduced finished product failures, and reduced waste. Many industries are beginning to understand the advantages of QbD and are currently in investigational or implementation phases – most notably the pharmaceutical industry. But in reality, QbD should be considered (and already is in some cases) by most all product development and manufacturing industries.

One key component of QbD is the early identification of CQAs of materials that are used in production. A CQA is defined as a physical, chemical, or biological property or characteristic that typically involves a set of limits, ranges, or distributions to ensure a desired product or material quality. As CQAs are identified, processes can be put into place to control, monitor, and test the materials to ensure they meet the standards required to produce a desired outcome.

Today, there are many analytical testing technologies available for the identification of CQAs. Why not use them? Whether the testing is internalized or outsourced, there are numerous resources at the fingertips of development scientists and engineers. Analytical service labs have a multiplicity of analytical services and expertise in their respective fields that can assure a quality contract service. Allocating resources for a capital expenditure (e.g., instrumentation) or choosing analytical outsourcing services to conduct the tests is becoming a necessity. Scientists and business managers toil with these decisions every day. Oftentimes the outcome is the same. Either do it now, or do it later – often at a greater expense due to delays caused by product failures and changes to processes. Development engineers and scientists are incorporating the science and technology available for materials characterization into their processes. Most, if not all, who invest in the identification of key material properties are not disappointed in the time and expense incurred. Instead, they are reaping rewards for the extra effort in the form of superior product quality at a reduced cost.

Early identification of material CQAs is critical. Many companies will outsource a battery of analytical testing on batches of manufactured and raw materials to pinpoint the property that will predict performance at later stages in the process. Once that property is identified, the decision is made to continue outsourcing or to internalize the testing through integration of instrumentation or testing methods. Navigating the available testing technologies and the expertise required to execute the test can be overwhelming but, if done judiciously, the result is often early detection of CQAs and process improvements.

Identification of CQAs helps to create better product specifications and process control implementation that positively impact finished product quality. Though difficult to put a number on the cost savings, companies see increases in productivity and overall product quality that can be directly tied to early identification of material CQAs.

If you would like more information about determining Critical Quality Attributes or Quality by Design, please contact:

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* Micromeritics Pharmaceutical Services is a DEA-licensed, FDA-registered, cGMP/GLP-compliant contract analytical laboratory specializing in the determination of physical characteristics of materials.

Particulate Systems Expands its Product Line

Recently, Micromeritics embarked on a program to aggressively market an auxiliary selection of new and innovative products to complement its already extensive line of materials characterization instruments. In the fall of 2008, Micromeritics introduced its Particulate Systems brand with an initial portfolio of two products. The Particle Insight dynamic particle size and shape image analyzer is ideal for applications where the shape, not just the diameter, of raw materials is critical. The High Pressure Volumetric Analyzer (HPVA) is designed to measure high-pressure adsorption isotherms with hydrogen, methane, carbon dioxide, and other gases using the static volumetric method. Since then, the brand has expanded its product line with seven additional products.

The MA-1040 magnetic analyzer detects and measures low levels of metallic iron content of sample materials. Knowing the concentration of metallic iron in raw materials is critical to controlling the quality of the finished product.

DVS Advantage

Under a strategic collaboration between Surface Measurement Systems and Micromeritics, three products are represented by the Particulate Systems brand. The Dynamic Vapor Sorption (DVS) Advantage utilizes a gravimetric technique for studying water and organic vapor sorption/adsorption on particulate materials.

The DVS Intrinsic rapidly measures uptake and loss of moisture in the sample by flowing a carrier gas at a specified relative humidity.

SEA

The Surface Energy Analyzer (SEA) is the latest development in chromatographic sorption technology. Based on Inverse Gas Chromatography (IGC) methodology, the SEA is capable of characterizing a wide range of surface and bulk properties of solids, particulates, fibers, and thin films.

H.E.L. Subsieve AutoSizer

The H.E.L. Limited Subsieve AutoSizer (SAS) is a new addition to the established field of air-permeability particle sizing. It has been developed as a direct and improved successor to the widely used Fisher Model 95 Sub-Sieve Sizer (FSSS). The SAS adds automated functions and electronically recorded and presented data to an established particle sizing technique. The SAS uses the principle of pressure drop across a packed bed of powder.

VASCO DLS

The Cordouan VASCO dynamic light scattering particle size analyzer combines back-scattered light detection and the capability to control sample thickness. The VASCO provides higher detection efficiency for opaque samples and decreases the instrument sensitivity to multiple scattering. With its temperature stabilization feature, the instrument is capable of measuring particle size in a range from 6 micrometers to 1 nanometer.

The PID Microactivity-Reference (MAR) is an advanced modular laboratory system for measuring the activity and selectivity of catalysts. The standard platform can be easily adapted to the user's catalytic testing needs with a variety of configurations and options. The system can accommodate reactions that include hydrocracking, hydrotreating, isomerization, hydrogenation, hydrodesulphurization (HDS), oxidation, hydrodenitrogenation (HDN), polymerization, reforming (aromatization), and steam reforming, to name a few.

Particulate Systems continues on an ongoing basis to search for additional opportunities to meet the needs of Micromeritics customers. Small companies and independent innovators with novel instrument designs benefit from Micromeritics' extensive sales and support network while end-users have access to new and exciting technology that otherwise may have remained obscured by more prominent or better-funded manufacturers.

MICROMERITICS ANALYTICAL SERVICES The Particle Testing Authority

MAS has recently added the ability to perform DSC, modulated DSC, and TGA analyses. Current customers also have a need for thermal analysis; therefore adding these top-of-the-line products from TA Instruments is a nice complement to our existing services. As always, looking for new ways to serve our customers' needs is a top priority.

We are very proud of the fact that the MAS has not increased prices since 2007. We constantly look at our pricing structure and work hard at reducing costs so that an overall price increase is not necessary. However, there are a few tests that will require increases in 2011. Please make note of the fact that the new MAS price list will go into effect on January 1, 2011. We will be sending out this new price list as we get closer to the end of the year.

MAS has been preparing this year for the implementation of a new LIMS for its laboratory. This system will allow us to automate a lot of tedious tasks which will help us to better serve our customers. A key feature of the LIMS will be a web portal that customers can use to access and archive their projects. We look forward to showing off our new system starting October 1, 2010.

TGA Q5000

www.particletesting.com

Meet the newest member of MAS

Traci Caillouet is our newest lab analyst. Trace, as she likes to be called, is originally from Louisiana and has lived in Atlanta since 2005. She graduated from Southwest Texas State University with a bachelor's degree in Biology/Chemistry. Trace spent more than 10 years working in quality control laboratories for Huntsman Corporation and Mohawk Industries before coming to Micromeritics. Trace has been working in MAS for about six months, primarily on projects related to gas adsorption, surface area, and pore size analysis. She has demonstrated that she is extremely well organized and capable of handling whatever challenges come her way. Trace is a great asset to the MAS. Please feel free to contact Trace with your gas adsorption questions.

MAS Events

ACIL
October 9 - 12
San Diego, CA

ALMA
November 3 - 6
Scottsdale, AZ

AIChE
November 7 - 12
Salt Lake City, UT

AAPS
November 14 - 18
New Orleans, LA

Instrument Training

Micromeritics provides basic start-up training for most instruments during installation. However, when operators wish to maximize their proficiency and broaden their capability with their Micromeritics instrument, more advanced training is needed. To achieve this goal, Micromeritics offers for most instruments targeted classes in which customers may expand their ability and improve their understanding by learning from the experts who designed their instruments. These classes, periodically held at Micromeritics' headquarters in suburban Atlanta, Georgia, include:

Theory Overview
Learn about the science upon which each instrument is based and how this science applies to successful sample preparation, analysis, and results interpretation.

Detailed Operations
Effective sample file creation, use of analysis parameters, and manual sample entry are all covered. Increase efficiency and learn to use the full power and flexibility of the operating software.

Automatic Analyses
Develop correct analysis procedures to optimize collection of accurate, reproducible data. Much class time is spent performing hands-on analyses in a controlled, tutorial environment.

System Utilities
Learn instrument software utilities which help manage sample files and directories, protect data, and select system options.

Report Optimization
Learn to configure reports and obtain the most useful information, as well as improve report comprehension.

Troubleshooting
Learn techniques to quickly locate and resolve instrument and software problems.

User Maintenance
Under the guidance of a Micromeritics Maintenance Specialist, practice routine maintenance procedures which improve operation, reduce downtime, and increase data accuracy.

Course Enrollment
Training courses last from two to four days and are designed to provide hands-on, performance-based instrument skills and knowledge. Small classes allow individual instruction and peer interaction. Course materials include a Study Guide, a complimentary copy of *Analytical Methods in Fine Particle Technology*, and a wealth of other educational material. A Certificate of Completion is awarded to each trainee.

Visit www. micromeritics.com, select Service Center, and then Training Center for additional information, to enroll for a specific course, or for a complete course schedule.

Visit our website for the complete 2010 course schedule and registration. www.micromeritics.com

2010 Training

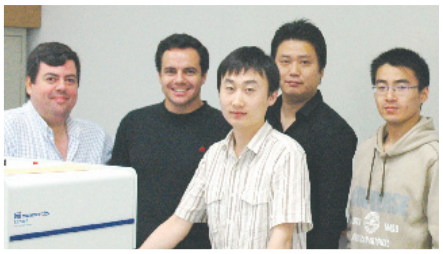
AutoChem II 2920
August 17 - 19

TriStar® II 3020
August 24 - 26

Gemini® VII 2390
August 31 - September 1

AutoPore IV
November 2 - 4

For additional information or to register for the class of your choice, visit www.micromeritics.com/Service-Center/Training-Class-List.aspx or phone 770.662.3607. Early registration is recommended since class space is limited.



Students attending a recent Elzone course

Events

ACS National Expo
August 22 - 26, 2010
Boston Convention & Exhibition Center
Boston, MA

MOF 2010
September 5 - 9, 2010
Palais du Pharo
Marseille, France

JAIMA 2010
September 1 - 3, 2010
International Exhibition Halls, Makuhari Messe
2-1 Nakase, Mihama-ku,
Chiba-city, Chiba Prefecture, Japan

ILMAC 2010
September 21 - 24, 2010
Exhibition Center Basel
Basel, Switzerland

Visit our website for a complete Event schedule www.micromeritics.com

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Attention Authors

We welcome articles and information concerning particle technology applications performed with Micromeritics instrumentation. Everything from a single plot with operating conditions to an in-depth article on physisorption, chemisorption, etc. with supporting graphs will be considered. If your material is published in The microReport, you will receive a copy of Analytical Methods in Fine Particle Technology by Paul A. Webb and Clyde Orr.

Send your article to:
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Include your title, return address and phone number. Contributions cannot be returned, but each will be acknowledged.

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