THE microReport

micromeritics®
The Science and Technology of Small Particles™

MICROMERITICS INSTRUMENT CORPORATION

VOLUME 16 NO. 2

## In This Issue



CERTIFIED ISO9001 MANUFACTURER NORCROSS, GA

www.micromeritics.com

# Introducing the High-Throughput ASAP 2420 Accelerated Surface Area and Porosimetry System

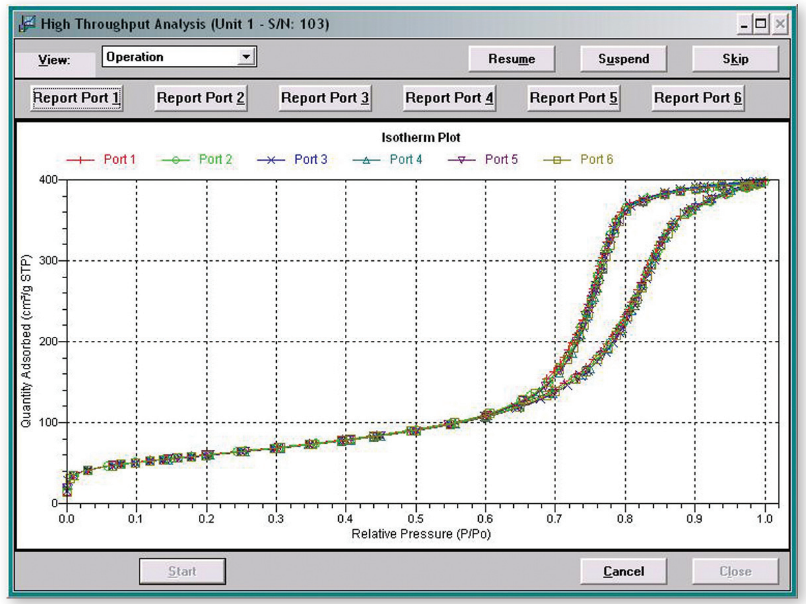
Micromeritics is pleased to introduce the new, high performance ASAP 2420, specifically designed for laboratories where high sample throughput is a strategic priority.

The fully automated ASAP 2420 rapidly and reliably produces accurate and repeatable surface area and porosity determinations revealing critical characteristics of your samples. It features an extensive set of analytical capabilities for producing high-quality surface area and porosimetry information for product development, production monitoring, and quality control of materials such as pharmaceuticals, ceramics, carbons, catalysts, paints, coatings, and propellants.

## Analysis System

The analysis system consists of six sample ports (five ports when the krypton option is used), each permitting loading, analysis, and unloading of samples without interfering with the operation of the other ports. Each sample port has its own pair of analysis and saturation pressure ($P_0$) measurement transducers. Imagine, six parallel BET surface area analyses achieved in as little as 30 minutes.

With the ASAP 2420, versatility and simplicity of operation are available in the same instrument. For example, you can select to have saturation pressure automatically measured either continuously or at selected intervals, or you can




*The ASAP "HighThroughput" analysis allows users to start up to six analyses simultaneously. The results from six samples of high surface area silica-alumina are shown here.*

manually enter a $P_0$ value. Similarly, the analysis temperature can be calculated or measured automatically, or manually entered. The system allows dosing controlled by volume increments or by a pressure table. The first pressure point can be dosed differently from subsequent (higher) target pressures in order to rapidly meet the adsorptive demand of the sample in achieving the first point, a feature that saves considerable time. Thereafter, dosing is controlled by the adsorbed (or desorbed) quantity of gas or by a table of target pressures that you specify.

Measuring the volume adsorbed or desorbed under equilibrated conditions is critical to obtaining accurate data. An equilibration option on the ASAP 2420 allows you to specify equilibration times for different parts of the isotherm, thus carefully probing size ranges where porosity needs to be characterized and rapidly screening size ranges where no porosity is expected. Once an analysis protocol is designed, it can be named, stored, and applied to any future analyses.

Anyone who has performed high-resolution measurements of adsorption/desorption isotherms knows that these analyses can be very long due to the number of data points to be collected. With some instruments, this results in abnormal termination of the analysis due to depletion of the cryogen prior to closure of the isotherm. To avoid this, the analyst is forced to limit the number of data points, therefore, sacrificing resolution or collecting data points prior to equilibration. Not so with the ASAP 2420. Utilizing larger Dewars and Micromeritics' patented Isothermal Jackets, the ASAP 2420 permits extended analyses to be performed with a constant thermal profile along the length of both the sample and $P_0$ tubes without the need to refill the Dewar.

## Sample Preparation System

A crucial step in obtaining valid data is the preparation of the sample for analysis, and a necessity for repeatability and reproducibility is to be able to follow the same preparation protocol time after time. The ASAP 2420 preparation system is fully automated with controlled heating profiles and all preparation parameters are stored and reported with the analysis data. The temperature, ramp rate, and soak time can be set and monitored for each port and controlled from a few degrees above ambient to 450 °C. A programmable pressure threshold will suspend the temperature ramp if the outgassing pressure exceeds the amount specified.

## Data Reporting

Reduced data can be displayed or printed in a variety of easy-to-interpret tabular and graphical reports. In addition to typical reports such as BET and Langmuir surface area, t-Plot, and BJH pore size distribution, the ASAP 2420 also features the STSA thickness curve, and DFT pore size and surface energy reports.

If high throughput, reliability, versatility, ease of use, and high quality data describe the needs of your particle characterization laboratory, then Micromeritics' new ASAP 2420 is a "must see." Visit us at www.micromeritics.com and get complete details.



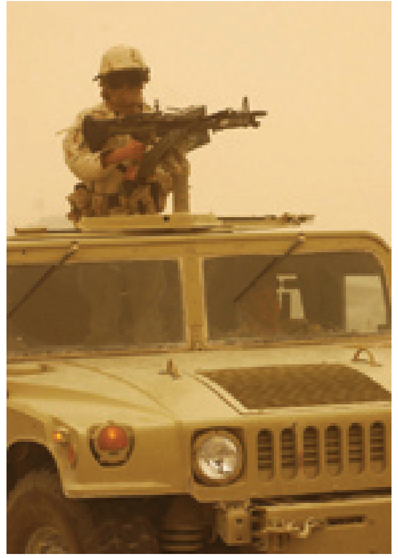


# DRI Scientists Discover Affects of Desert Dust on Military Operations in Iraq

*Todd Caldwell, Assistant Research Soil Scientist*

For the U.S. Army to operate successfully on a global scale, current and future troops as well as their equipment must be capable of accomplishing any mission in all possible environments: cold or hot, wet or dry, and every possible combination of terrain. This requirement challenges the Army's equipment, people, and training programs. To prepare for a full spectrum of operations, the Army develops and tests its equipment under extreme environmental conditions to ensure that America's soldiers have the best that science and technology can provide.

Further, units conduct training in a realistic manner and in environments that simulate various natural settings. Finally, the Army must collect and analyze environmental data necessary to successfully plan for contingencies worldwide. A particular and critical issue has evolved from U.S. combat experience in Iraq.



U.S. Army photo courtesy of GeekPhilosopher.com

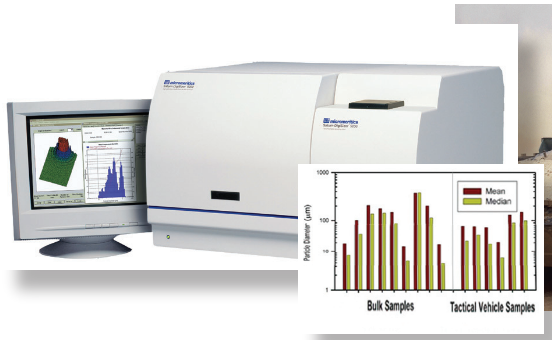
Troops have reported that their individual combat weapons (M4 and M16 rifles) were jamming and failing to fire dependably. No specific causes were identified, but anecdotal information suggested that the problem was related to high levels of dust in the area combined with the properties of standard Army cleaner, lubricant, and preservative (CLP). Some troops had acquired commercially available gun lubricants that were reported to work better.

An Army study (King et al., 2004) identified that dusts present in the world's deserts vary greatly in physical and chemical properties, variables that have significant implications for military operations. This recent experience and knowledge has reinforced the importance of understanding the impacts of desert environments on military operations, especially in critical areas such as proper functioning of weapons.

Recognizing that weapons jamming could be related to physical and chemical properties of dust, the Desert Research Institute (DRI) was commissioned by the Army to undertake an analysis of a limited number of Iraqi dust samples collected during the period 27 March – 8 April 2004 by an onsite geologist of the U.S. Army Corps of Engineers.

The purpose of this study is to describe the physical and chemical properties of sampled Iraqi dust, to analyze how this dust reacts with gun lubricants used in Iraq, and to develop recommendations for additional testing that would contribute to solving the gun-jamming problem for U.S. soldiers. This first-phase study is intended to provide a scientific basis for addressing dust-related aspects of the problem, not to provide a final solution.

Fifteen Iraqi dust samples were collected in total. Of these, nine were bulk surface soils collected at a variety of locations and were intended to capture some of the variability in dust sources based on the geology and geomorphology of the region. To evaluate potential differences between parent soils and resultant dust, six additional samples were taken inside tactical vehicles where weapons were stored or transported. All samples were analyzed to determine particle size, chemical composition, and reactivity of soil or dust components. Eight of the samples were tested to determine reactivity with three types of gun lubricants, including gov-



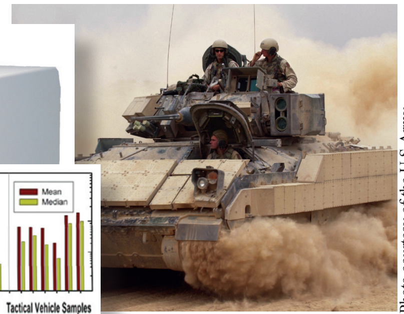



Photo courtesy of the U.S.Army

ernment stock CLP and two commercial products that troops found to work better than standard CLP.

Analytical results describing physical and chemical properties of the Iraqi dust samples provide scientific guidance for the next steps in solving dust-related problems. The most critical findings from this study are:

- Soils and dust collected from areas of military activity in Iraq differ significantly from the material used in chamber-testing procedures for weapons and are unlike natural geologic materials to which weapons are exposed during most training environments in the U.S.
- The concentration of reactive chemicals, primarily salts and carbonates, is high in all Iraqi dust and soil samples and extremely high in many. Several of these reactive chemical components have the potential to corrode metal parts.
- The average particle size of dust encountered in military operations in arid regions is much smaller than laboratory-generated quartz surrogate dust used in sand-and-dust chamber testing of weapons. Army experience has clearly shown that natural dusts have a significant impact on weapons operation and other mechanical equipment.
- With the aid of Micromeritics' Saturn Digisizer® 5200, tests have shown that three gun lubricants react with Iraqi dust, forming aggregates that increase the average size of particles in the sample. The extent of the reaction varies among dust samples with different chemical compositions and grain sizes. In general, dusts higher in salts and carbonates, and with smaller particles, are most reactive when mixed with the lubricants.
- The average particle size of dust taken from vehicles in Iraq was significantly smaller than the particle size of bulk soil samples. Further, the samples from vehicles had a higher concentration of reactive carbonates and sulfates. This reinforces that current chamber test methodology misrepresents real-world conditions.

Identifying the complete cause of gun-jamming problems experienced in Iraq must include testing with actual dust, or the equivalent, from the areas where the problems occurred. Differences in bulk soil samples compared with dust found in military vehicles operating in Iraq verify that operational considerations must be included in design-ing tests to evaluate and resolve this issue. Moving vehicles, and the weapons carried therein, act as natural dust traps for the smallest, and most potentially reactive, dust particles.

Given the importance of Iraqi dust in its potential to impact military equipment and operations, desert environmental parameters are critical to design tests that reflect real-world conditions—especially conditions most likely to compromise use of critical equipment in harsh desert environments. Previous work by King et al. (1999, 2004) demonstrated that each type of equipment test has a unique set of environmental conditions that is critical to the success of that test. Further analyses of the chemical properties of Iraqi dust are recommended to evaluate potential for corrosion and related impacts to military equipment.

This study quantified physical and chemical characteristics of dust derived from soils sampled in Iraq. This dust was found to be highly variable based on its origin and significantly different from the quartz materials used for standard chamber dust tests of military equipment.

Further, the high concentrations of reactive chemicals and high volumes of fine clay materials were observed to react with chemicals found in gun lubricants.



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# Micromeritics Software Engineering Support

Micromeritics boasts a fully staffed software engineering department dedicated to obtaining the most reliable data possible from Micromeritics' wide variety of particle characterization instruments. As a manufacturer of computer-controlled automatic analytical laboratory instruments, Micromeritics understands the importance software plays in the overall quality of the end product. Software not only controls and monitors our instruments; it gathers, reduces and reports data, and provides an interface between the instrument and the operator. To ensure ongoing development and support of superior software, Micromeritics employs an in-house software engineering department with experience that is extensive and varied.

Stefan Koch, Software Engineering Manager, received his B.S. in Physics and Mathematics from Allegheny College and his Masters in Science from Cornell University.

Dr. Sam Varner earned a Bachelor's Degree in Physics from the Indiana University of Pennsylvania and PhD at the College of William and Mary where he developed experimental and computational techniques in solid-state nuclear magnetic resonance.

Bill Conklin, received his Bachelor of Science in Computer Science and Engineering from the Massachusetts Institute of Technology. He has been involved in software development and instrument design at Micromeritics for over 25 years and is co-inventor for several Micromeritics patents.

Gary Austin, Phi Beta Kappa at Rutgers College, has done department management and software development at Lanier Business Systems, Exxon Office Systems, Mohawk Data Science, and Index Terminals.

Jean-Luc Albert received his B.S. in Computer Science and graduated Magna Cum Laude from Louisiana State University.

Jeff Gantner earned his Bachelor's Degree in Mathematics/Computer Science from Florida State University and has over 25 years of experience in software development.

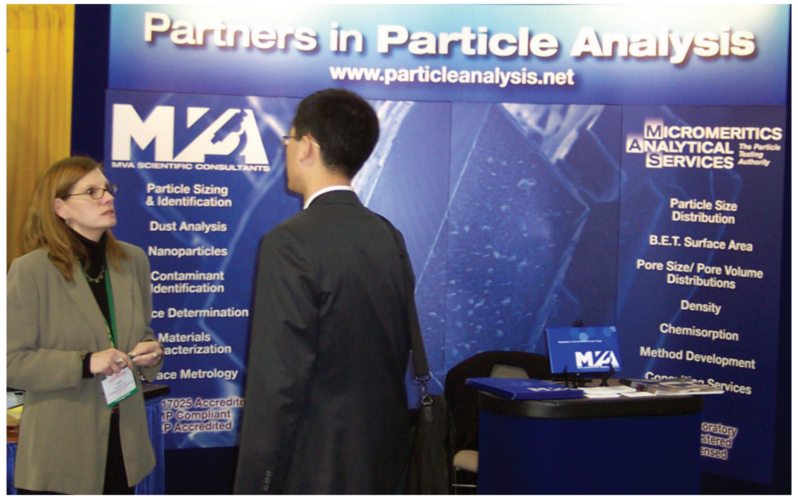
Leo Guray earned his Masters of Science from the University of Vilnius. Prior to joining Micromeritics, he developed medical, analytical instrument management, and business software.

Derek Dolney earned his B.S. degrees in Physics and Chemistry at the University of Minnesota. As a graduate student at the University of Pennsylvania, Derek was involved in cosmology research, mostly simulating and modeling structure formation in the universe. His graduate work yielded three more publications and earned him a PhD in Physics.

*"Our mission is to develop software that gets the maximum functionality out of Micromeritics instruments. We continually consult with our applications scientists and review technical articles to stay on the cutting-edge. We are dedicated to getting the most reliable data possible and reporting that data in a way the customer wants to see with a consistent easy-to-use interface across our entire range of instruments."*

*Stefan Koch, Software Engineering Manager*

Micromeritics Analytical Services attended the 2005 AAPS National Meeting, exhibiting with our strategic partner MVA Scientific Consultants. We currently are planning our exhibition calendar for 2006. Look for it on our web site, www.particletesting.com.




## Micromeritics Analytical Services acquires a new particle size analyzer that accommodates both dry and wet sample dispersion protocols using the laser light scattering technique.

For most applications, we prefer to disperse samples in a liquid. We believe liquid sample dispersion provides a more repeatable and reproducible sample introduction technique than does dry sample dispersion. However, there are a number of customers who have samples that cannot be dispersed in a liquid and can only be analyzed using a dry technique. In some cases, dry sample dispersion may yield a more acceptable particle size result, especially if the material is used in a dry process. Micromeritics Analytical Services offers customers a choice of seven different analytical techniques and dozens of methods for measuring particle size, each with specific advantages in targeted applications.

### Laser Light Scattering
All industries; pharmaceutical, medical, mining, metal, ceramic, and catalyst to name a few

### Sedimentation
Heavily used in ceramic, mining, and metal industries

### Electrical Zone Sensing
Pharmaceutical, abrasives, biological, particulate concentration, wastewater, and stack-emission filter testing

### Dynamic Image Analysis
Plastics, catalysts, and resins

### Microscopy
All industries; also useful to identify unknown contaminants, dispersion stability, and sample morphology

### Sieve Shaker, Wet and Dry methods
Inexpensive, low-resolution particle size analysis

### Mayer and Stowe Calculations using Mercury Porosimetry
Magnetic materials

Greg Thiele
Business Manager
mas@micromeritics.com
www.particletesting.com
Phone: 770-662-3630





# Micromeritics Instrument Training Courses

Training is provided for most Micromeritics instrumentation at the time of installation. This training presents all the information required for a new operator to quickly become proficient operating the instrument. In cases where personnel changes occur or more advanced training is required, Micromeritics conducts a variety of classes for many of our instruments. These courses are held at our headquarters in suburban Atlanta, Georgia. The courses include:

**Detailed Operational Procedures**
Items covered are effective sample file creation, use of analysis parameters, and manual sample entry. You´ll learn how to utilize the full power and flexibility of the operating software.

**Automatic Analysis**
Develop correct analysis procedures to optimize collection of accurate, reproducible data. Much of the class time is spent performing analyses in a controlled, tutorial environment.

**Systems Utilities**
Discover all of the instrument software utilities which help you manage sample information files and directories, protect data, and select system options.

**Troubleshooting**
Learn techniques that enable you to locate and quickly resolve instrument problems.

**Report Generation and Comprehension**
Learn to configure reports and obtain more useful information, as well as improve comprehension of the reports produced.

**User Maintenance**
Practice routine maintenance procedures which improve operation, reduce downtime, and increase data accuracy.

**Theory Overview**
Learn about the scientific theory upon which each instrument is based and how it applies to the critical factors relevant to successful sample preparation and analysis performance.

**Enrollment**
Training courses last from 2 to 3 days and are designed to provide hands-on, performance-based instrument knowledge. Small classes guarantee close individual attention. Included in the course materials are a Study Guide, an instrument Operator´s Manual, and other handout materials. Certificates of Completion are also awarded to all trainees.

**Training 2006**

SediGraph 5120
January 24 - 26

AutoPore IV
January 31 - February 2

ASAP 2020 Physi/Chemi Combined
February 28 - March 3

Gemini V
April 11 - 12

TriStar 3000
May 23 - 25

For additional information or to register for the class of your choice, contact the Micromeritics Training Department at 770.662.3607. Early registration is recommended since class space is limited.

# Events

**The 30th Int'l Conference & Expo on Advanced Ceramics and Composites**
January 22 - 27, 2006
Hilton Ocean Front Hotel
Cocoa Beach, FL

**IFPAC - Process Analytical Technology**
February 20 - 23, 2006
Crystal Gateway Marriott
Arlington, VA

**Labortechnika**
February 21 - 24, 2006
Budapest Fair Centre Pavilion F and F2
Budapest, Hungary

**Pittcon 2006**
March 13 - 16, 2006
Orange County Convention Center
Orlando, FL

## 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 plots 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:
James Kerce, Editor
The microReport
MICROMERITICS
One Micromeritics Drive
Norcross, GA 30093-1877
james.kerce@micromeritics.com

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

## How To Reach Us

Micromeritics offers over 50 sales, service, and distribution offices throughout the world. For additional information, a free product demonstration, or the location of the office nearest you, call or write:

### HEADQUARTERS:

Micromeritics Instrument Corporation
One Micromeritics Drive
Norcross, GA 30093-1877
USA
Telephone:

| | |
|---|---|
| U.S. Sales | (770) 662-3633 |
| International Sales | (770) 662-3660 |
| Fax | (770) 662-3696 |

WEB: www.micromeritics.com

### SUBSIDIARIES:

**Micromeritics China**
Apt. 5H, No. 1 Building
Hua-Ao (Epoch Center)
No. 31 Zi Zhu Yuan Road, Hai Dian District
Beijing 100089, P.R., CHINA

| | |
|---|---|
| Tel: | (+86) (0)10-6848-9371 |
| Fax | (+86) (0)10-6848-9371 |

**Micromeritics France S.A.**
Parc Alata
Rue Antoine Laurent Lavoisier
60550 - Verneuil en Halatte
FRANCE

| | |
|---|---|
| Tel: | (+33) (0)33-3-44-64-6080 |
| Fax: | (+33) (0)33-3-44-64-6089 |

**Micromeritics GmbH**
Erftstrasse 54
D-41238 Mönchengladbach. GERMANY

| | |
|---|---|
| Tel: | (+49) (0)2166-98708-0 |
| Fax: | (+49) (0)2166-98708-88 |

**Micromeritics Ltd.**
Unit 2, Chestnut House
178-182 High Street North
Dunstable, Bedfordshire LU6 1AT
ENGLAND

| | |
|---|---|
| Tel: | (+44) (0)1582-475248 |
| Fax: | (+44) (0)1582-475252 |

**Micromeritics N.V./S.A.**
Eugene Plaskylaan 140B
1030 Brussels, BELGIUM

| | |
|---|---|
| Tel: | (+32)2-743-39-74 |
| Fax: | (+32)2-743-39-79 |

**Micromeritics SRL**
Via W. Tobagi n. 26/7
20068 Peschiera Borromeo
Milano, ITALY

| | |
|---|---|
| Tel: | (+39) (0)2 553 02833 |
| Fax: | (+39) (0)2 553 02843 |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(770) 662-3654


Subscriptions are free to particle technology users and can be started simply by writing to The microReport editor.



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Micromeritics
One Micromeritics Drive
Norcross, GA 30093-1877, U.S.A.

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