

- 8 Laser Ablation for Direct ICP and ICP-MS Analysis**
STEVEN K. HUGHES, ROBERT C. FRY, JOSEPH BRADY
 Laser ablation eliminates lengthy sample preparation steps normally required for analyzing solids by ICP and ICP-MS, offering an option for spatially resolved analysis of isolated small features on a heterogeneous solid sample surface, while allowing precision depth sampling and profiling.
- 14 WS-CRDS - Revolutionizing Trace Gas Analysis From ppt to Percentage Levels**
AARON VAN PELT, IAIN GREEN, PH. D.
 Wavelength-Scanned Cavity Ring Down Spectroscopy can combine the ppt sensitivity and species discrimination of separation science with the speed and simplicity of optical technology.
- 18 The Advantages of Mass Flow Meters & Controllers in Fuel Cell Test Stands**
JAN CHRISTENSEN
 Choice of MFCs for test stands must ensure accuracy at different flow rates and consider turndown and calibration
- 21 ALD Valves for Next-Generation Energy Conversion Devices**
TIM HOLME, FRITZ PRINZ, PH.D., JOHN BAXTER
 How Stanford University engineers met the challenge of finding an ALD valve with sufficient speed and purity that was able to meet temperature and reactive chemical demands
- 24 "Smart Building" Technology for Air Safety Monitoring: Sensor Network Design Tool**
DONALD R. SCHROPP, JR.
 Software for predictive modeling of toxin migration and lethality within building structures to optimize the placement of CB sensors in buildings, transportation hubs, and other public venues
- 34 Executive Views: Regulations for Non-Refillable Gas Cylinders**
LELAND STANFORD
 After September 11, 2001, new regulations were needed to allow non-refillable gas cylinders to be transported by boat or by air

DEPARTMENTS

- | | | | |
|----------|------------------|-----------|--------------------------------------|
| 4 | Editorial | 30 | SEMICON West Product Showcase |
| 6 | News | 33 | Ad Index |
| 7 | Calendar | | |

On the Cover: Cover photo courtesy Spectra_Lase; Shown is the Spectra-Lase "RAD-8" (lower module), comprehensively "rad-hardened" laser ablation system (the world's first) being installed in a radiation "Hot Cell", for analysis of processed nuclear waste (radioactive glass).

Gases & Instrumentation Magazine™ (ISSN 1937-6774) is published six times per year, by MetaWord, Inc. 77 Elmwood Road, Wellesley Hills, MA 02481, and at additional mailing office. A requester publication, *Gases & Instrumentation Magazine*™ is distributed free to qualified subscribers in North America. Non-qualified subscription rates in the US and Canada: \$120 per year. All other countries: \$180 per year, payable in U.S. funds. Back issues may be purchased at a cost of \$15 each in the U.S. and \$20 elsewhere. While every attempt is made to ensure the accuracy of the information contained herein, the publisher and its employees cannot accept responsibility for the correctness of information supplied, advertisements, or opinions expressed. POSTMASTER: Send address changes to *Gases & Instrumentation Magazine*™, 77 Elmwood Road, Wellesley Hills, MA 02481. ©2008 *Gases & Instrumentation Magazine*™ by MetaWord, Inc. All rights reserved. No part of this publication may be reproduced without permission from the publisher. Permission is granted for those registered with the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923 (phone: 978-750-8400; fax: 978-750-4470) to photocopy articles for a base fee of \$1 per copy of the article plus \$.35 per page. Canadian Agreement number: PM40063731; Return Undeliverable Canadian Addresses to: Station A P.O. Box 54 Windsor, Ontario N9A 6J5; Email: returns@imex.pb.com

Note: *Gases & Instrumentation* periodically publishes product-related articles about the technology of new products or innovative technologies introduced into existing products. This is to explain the technology in a non-commercial way to inform potential end-users of technology that may suit their application. *Gases & Instrumentation* does not verify the test results noted, nor does *Gases & Instrumentation* endorse these products. The technology is presented for informational purposes only. This magazine is printed on 100% recycled paper.

Editorial

Paul Nesdore
Chief Editor
 pnesdore@gasesmag.com

Gail Glintenkamp
Executive Editor
 gglintenkamp@gasesmag.com

Ludwig Haase
Technical Editor

Beth Hinchliffe
Editorial Consultant

Editorial Advisory Board

John Baxter
Manager, Product & Technology
 Swagelok Semiconductor Services Company

Lloyd Brown, Ph. D.
Semiconductor Process Gases R&D Manager
 Praxair

Robert Ford
Bulk Specialty Gas Manager
 Air Products

Carter Hall
Director of Technical Services
 SSC

Joaquin Victor Martinez De Pinillos, Ph.D.
Senior Scientist, National Institute of Standards and Technology (NIST)

Kavita Murthi
Sub-Atmospheric Gas Products Marketing Manager
 Matheson Tri-Gas

Andrew Tipler
Senior Staff Scientist, Chromatography
 PerkinElmer

Stephen Vaughan
President
 Custom Gas Solutions

Art and Production

Alice Scofield
 ascfield@gasesmag.com

Administration

Paul Nesdore
CEO/Publisher
 pnesdore@gasesmag.com

Advertising Sales

Luann Kulbashian
Sales Director
 kulbashian@gasesmag.com

David Brower, Ph. D.
Consultant

Customer Service

service@gasesmag.com

Executive Offices

MetaWord Inc.
 Wellesley, MA 02481
 Phone: 781-431-7168/Fax 781-431-2696
 www.gasesmag.com

Regulations for Non-Refillable Gas Cylinders

LELAND STANFORD

After September 11, 2001, new regulations were needed to allow non-refillable gas cylinders to be transported by boat or by air.



Trans-filling gases into disposable cylinders has long been a small industry that has taken on new meaning in the last several years. Government regulators and customers have voiced strong concerns for travel safety and regulatory standing in an industry that is growing fast.

Disposable non-refillable cylinders are segregated by Hazardous Materials Regulation (HMR) 49 CFR into two groups; those that are over 4 fluid ounces of water capacity; and those that are less than that. Over 25 years ago the FAA opted to regulate over water flights to have specific safety items for passengers, namely inflatable life jackets. These have been made ever since to the FAA's Technical Standard Order (TSO) C13. That action put about 1 million inflatable life jackets in the air, each containing 2 cylinders of 16g CO₂.

The United States Coast Guard (USCG) during that same period was pressured by the National Transportation Safety Board (NTSB), National Safe Boating Council and many industry safety advocates to get inflatable life jackets approved for recreational marine use in North America. The regulatory process was hampered by shifting design themes for over 10 years, but finally in 1996, the USCG put out a Notice of Proposal Rule Making (NPRM) in the Federal Register to allow the inflatable life jackets to be used as an approved device. That action instantly created a need to transport disposable gas-filled cylinders in all modes of transportation.

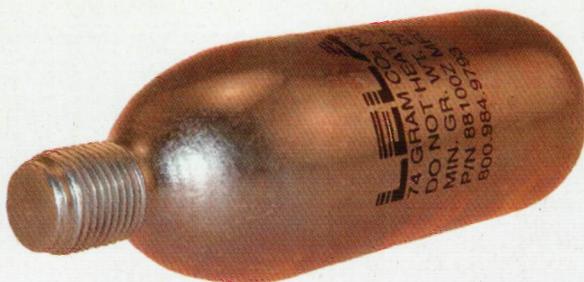


Figure 1. This 74g CO₂ filled, 98ml disposable cylinder is fitted with a puncture surface at the narrow end. Being 1.5" diameter x 5.2" long, this cylinder is at the limit for the DOT exception status as a 'Limited Quantity' according to 49 CFR.

Zeroing gases and calibration gases of certain purities have also been filled into these mass produced disposables used primarily for hand-held equipment. Gas monitor use in industry has ramped up since OSHA has been enforcing air monitoring in the workplace over the last six years. This has also significantly increased the need to transport and in some cases, carry disposable cartridges on board aircraft.



Figure 2. "Small as a pencil eraser" was the requirement put forth to the author in 1999... "and fill it to 3000 psi of Argon" became a standard product which the US medical field uses in many devices today.

The medical industry has also demanded truly miniature disposables filled with helium, argon and nitrogen to pressures over 3,000 psi. Leland Limited Inc. of New Jersey has pioneered these mini cartridges with regards to high quality mass production techniques, but quickly recognized that the regulatory arena was yet to be conquered. Drug delivery devices using a gas cartridge have been around for some time; however, the new-age marketing departments of these disposable device manufacturers called for non-restrictive movement for its customers. The burden of the regulatory quagmire shifted to the gas cylinder manufacturer/filler, Leland.

Going to Washington DC just after September 11, 2001 to discuss easing regulations for non-refillable gas cylinders was not for the faint of heart. The then newly formed Department of Homeland Security (DHS) was seemingly scrutinizing every substance

Continued on page 33

known to man that could in some way be used against the US. The Department of Transportation (DOT) offices at that time, especially the Research and Special Programs Administration, had DHS personnel concerned and focused on the safety of hazardous materials' movement in, through, and out of the US.

Leland understood that restricting the movement of certain disposable gas-filled cylinders meant consumers and technicians who relied on these gases would cause their uses to decrease thus affecting their effectiveness. It was as simple as a boat owner desiring to take CO₂ powered life jackets on vacation or a technician going to a facility to monitor air samples. Fortunately, President George Bush and his father like to go fishing and they are regular users of inflatable life jackets and advocates of boating safety.

Knowing this, Leland was relentless in pushing the issue, which was essential to get the DOT to make a formal interpretation of how 49 CFR affects airline passengers, their carry-ons and their checked baggage. Other interested parties included the CGA due to the use of oxygen by passengers and the DHS, specifically TSA.

There were likely dozens of petitioning entities for the cause, however, their identities may never be known.

Early in January of 2003 Leland was contacted by DHS to discuss what potential dangers existed in the disposable gas-filled cylinder industry and specifically, if airline passengers should be allowed to include such products for transportation by the airlines. Clearly, progress was in the wind.

On February 23, 2003 the Federal Register Vol. 68 No. 40 (9735) was published: Docket No. RSPA-2003-14424, Notice No. 03-2. It is entitled "Research and Special Programs Administration. Hazardous Materials: Formal Interpretation". The document clarified that essentially when someone travels and needs to bring a gas filled cylinder, it must be properly marked, labeled, classified and packaged in accordance with 49 CFR and when the airline issues a claim check for the bag/package, they then are responsible in the same way as when they accept air cargo in accordance with the CFR.

Most disposable gas cylinders filled with non-toxic and non flammable gases that are properly packaged and labeled,

can be placed in checked baggage. It is always best to contact the airline ticket counter and to speak with a supervisor far in advance of your travel day to become aware of that particular airline's documentation requirement. Failing to declare a hazardous substance to an airline is a felony with large fines.

Since the publishing of the Federal Register, The TSA announced on August 4, 2007 that passengers could bring life jackets with 2 spare CO₂ filled cylinders on board in carry-on luggage. It is an incremental step towards small gas packages being transported and the increased use of gases in a wide range of industries. **G&I**

LELAND STANFORD IS PRESIDENT OF LELAND LIMITED INCORPORATED OF SOUTH PLAINFIELD, NJ. HE HAS WORKED IN THE DISPOSABLE GAS FILLED CYLINDER BUSINESS FULL TIME SINCE 1985. A VOLUNTEER FIREFIGHTER FOR 23 YEARS AND APPOINTED TO THE COMMERCIAL FISHING INDUSTRY VESSEL SAFETY ADVISORY COMMITTEE FOR A SECOND TERM, HE HAS BROUGHT IMPROVEMENTS TO CYLINDER SAFETY IN MANY INDUSTRIES. HE CAN BE REACHED AT 908-561-2000 OR BY EMAIL: LEE@LELANDLTD.COM.

ADVERTISER INDEX

Advertiser	Page	Phone/Email	Web Address
Alcatel Vacuum Products, Inc.	Back Cover	781-331-4200	www.sensistorusa.com
Bronkhorst USA	Page 32		www.bronkhorstusa.com
Brooks Instrument	Page 23		BrooksInstrument.com
Ceodeux, Inc.	Page 13	800-325-5721	www.ceodeux-inc.com
Clark-Cooper Division	Page 20	856-829-4580	www.clarkcooper.com
Enmet Corporation	Page 7, 17	734-761-1270	www.enmet.com
Fluoramics, Inc.	Page 28	800-922-0075	www.fluoramics.com
GE Sensing	Page 27		www.gesensinginspection.com
MDC Semisystems	Page 28		www.mdcsemisystems.com
Pfeiffer Vacuum Inc	Page 31	800-248-8254	www.pfeiffer-vacuum.com
Picarro	Page 11		www.picarro.com
SEMICON Europa	Inside Back Cover	505-856-6716	www.svc.org
Sensor Electronics Corp	Page 5	800-285-3651	www.sensorelectronics.com
Swagelok Company	Inside Front cover		www.swagelok.com