# Vacuum References

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum Technology Books</td>
<td>2</td>
</tr>
<tr>
<td>Residual Gas Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Applications of Residual Gas Analyzers to Process/Quality Control</td>
<td>4</td>
</tr>
<tr>
<td>Specialized/Unusual Applications of RGAs</td>
<td>7</td>
</tr>
<tr>
<td>High Pressure Sampling/Differential Pumping</td>
<td>8</td>
</tr>
<tr>
<td>Quantitative Measurements with Residual Gas Analyzers</td>
<td>9</td>
</tr>
<tr>
<td>Multiple Linear Regression Analysis Algorithms</td>
<td>10</td>
</tr>
<tr>
<td>Vacuum System Design</td>
<td>10</td>
</tr>
<tr>
<td>Vacuum System Contamination</td>
<td>14</td>
</tr>
<tr>
<td>Vacuum Pumps</td>
<td>17</td>
</tr>
<tr>
<td>Total Pressure Measurement</td>
<td>20</td>
</tr>
<tr>
<td>Bayard-Alpert Ionization Gauges</td>
<td>21</td>
</tr>
<tr>
<td>Pirani/Thermocouple Gauges</td>
<td>24</td>
</tr>
<tr>
<td>Pressure Calibration/Spinning Rotor Gauge</td>
<td>25</td>
</tr>
<tr>
<td>Temperature Programmed Desorption</td>
<td>26</td>
</tr>
<tr>
<td>Membrane Introduction Mass Spectrometry (MIMS)</td>
<td>28</td>
</tr>
<tr>
<td>Variable Leak Valves</td>
<td>28</td>
</tr>
<tr>
<td>Vacuum and Process Control Publications</td>
<td>29</td>
</tr>
<tr>
<td>Vacuum and Process Control Websites</td>
<td>30</td>
</tr>
</tbody>
</table>
Vacuum Technology Books


6. John H. Moore et. al., “Building Scientific Apparatus: A Practical Guide to Design and Construction, 2nd edition”, Addison Wesley, Redwood City, CA, 1989. **Note:** Every science research laboratory must have a copy of this book on its shelves. The Vacuum Technology chapter (Chapter 3, p. 75) provides one of the best introductions to vacuum technology and vacuum system design we have ever seen!


Residual Gas Analysis


Applications of Residual Gas Analyzers to Process/Quality Control


Specialized/Unusual Applications of RGAs


10. Colin S. Creaser, David Gomez Lamarca, Jeffrey Brum, Christopher Werner, Anthony P. New and Luisa M. Freitas dos Santos, “Reversed-Phase Membrane Inlet Mass Spectrometry Applied to the Real-Time Monitoring of Low Molecular Weight Alcohols in Chloroform”, Anal. Chem. 74(2002) 300-304. NOTE: A SRS QMS300 is used to perform real-time MIMS determinations of alcohols in chloroform. RGAs are rapidly gaining acceptance in this field as their excellent price/performance value is realized by MIMS practitioners


13. C. Richard Arkin, et. al., “Evaluation of Small Mass Spectrometer Systems for Permanent Gas Analysis”, J. Am. Soc. Mass Spec. 13 (2002) 1004. Note: The SRS RGA100 is compared to several commercial (i.e. Leybold XPR-2 and Ferran Micropole) and research mass specs and found to be the best match for the analysis of cryogenic fuels around the Space Shuttle. This paper demonstrates the excellent accuracy, reproducibility and detectability of gas analysis systems based on SRS RGAs.


17. Marcus B. Wise, Michael R. Guerin, “Direct Sampling Mass Spectrometry”, Anal. Chem., News and Features, Jan 1, 1997, p. 26A. Note: This is a great paper on all the ways in which mass specs are used to provide real time data for environmental screening. This is very relevant for QMS system users.


High Pressure Sampling/ Differential Pumping


Quantitative Measurements with Residual Gas Analyzers


8. C. Richard Arkin, et. al., “Evaluation of Small Mass Spectrometer Systems for Permanent Gas Analysis”, J. Am. Soc. Mass Spec. 13 (2002) 1004. Note: The SRS RGA100 is compared to several commercial (i.e. Leybold XPR-2 and Ferran Micropole) and research mass specs and found to be the best match for the analysis
ofs of cryogenic fuels around the Space Shuttle. This paper demonstrates the excellent accuracy, reproducibility and detectability of gas analysis systems based on SRS RGAs.


Multiple Linear Regression Analysis Algorithms


Vacuum System Design


7. Phil Danielson, Vacuum & ThinFilm, March 1999, “Gas Load and Effective Pumping Speed”, p. 12, and “Creating a Vacuum”, p. 34.


14. Phil Danielson, Vacuum and Thin Film, June 1999, p. 12, “Gas Loads from Virtual Leaks”.


19. Ian Stevenson et. al., “Choosing a Chamber, Varouos Functions to Consider”, Vacuum & Thin Film, Sept. 1999, p. 23

20. Mike Ackeret, “Manipulators in a Vacuum: The challenge of manipulating samples in a controlled, ultra-clean or vacuum environment”, Vacuum & Thin Film, Sept. 1999, p. 31


22. Phil Danielson, “The Vacuum Chamber-Volume or Surface Area?”, Vacuum&ThinFilm, October 1999, p. 8.


Vacuum System Contamination


5. Vic Comello, R&D Magazine, December 1998, p. 43, ”Oil a Concern with Rotary Vane Pumps”

6. Phil Danielson, Vacuum & Thin Film Magazine, April 1999, p. 12, “Reducing Water Vapor, Problems with Dry Gas”


13. Phil Danielson, “Backstreaming Traps”, Vacuum & Thin Film, August 199, p. 8


29. Phil Danielson, “Using Simple Tools to Avoid Vacuum Performance Problems”, R&D Magazine, Dec 2001, p. 61. Note: This is an excellent explanation of how rate-of-rise and pumpdown curves can be used to characterize vacuum systems. IGC100 controllers offer front panel display of such curves, making system characterization very simple.


**Vacuum Pumps**


15. Phil Danielson, “Cryopump Crossover”, Vacuum&ThinFilm, November 1999, p. 8


**Total Pressure Measurement**


Bayard-Alpert Ionization Gauges

1. D. Alpert, Journal of Applied Physics 24 (1953) 860, “New Developments in the production and measurement of UHV”. Note: This is the report on the invention of the B-A Gauge


5. P. E. Gear, “The choice of cathode material in a hot cathode ionization gauge”, Vacuum 26(1) (1975) 3


34. Edelmann, Chr.; Iwert, Th.; Kauert, R.; Knapp, W., “Some studies of the axial emission ionization gauge according to Chen and Suen”, Journal of the Vacuum Society of Japan 37 (1994) 9, 686-691


**Pirani/Thermocouple Gauges**


_SRS-Vacuum Technology References_


**Pressure Calibration/Spinning Rotor Gauge**


15. P. Mohan “Vacuum Gauge calibration at the NPL (India) using orifice flow method” Vacuum 51(1998) 69


17. Kimo M. Welch, “A Poor-Man’s Traceable High Vacuum Gauge Calibration System”, Vacuum Technology and Coating, Nov/Dec 2000, p. 8. Note: This is a great article on how to make a simple calibration station for HV Gauge calibration.


**Temperature Programmed Desorption**


7. A. M. de Jong et. al. “Thermal Desorption Analysis: Comparative test of ten commonly applied procedures”, Surface Science 233 (1990) 355. Note: You must get this paper if you do not have it yet!

8. J. Gunster et. al., “Mg clusters on MgO surfaces: Characterization with metastable impact electron spectroscopy, ultraviolet photoelectron spectroscopy and temperature programmed desorption, A 17(4) (1999) 1657


### Membrane Introduction Mass Spectrometry (MIMS)


2. Colin S. Creaser, David Gomez Lamarca, Jeffrey Brum, Christopher Werner, Anthony P. New and Luisa M. Freitas dos Santos,”Reversed-Phase Membrane Inlet Mass Spectrometry Applied to the Real-Time Monitoring of Low Molecular Weight Alcohols in Chloroform”, Anal. Chem. 74(2002) 300-304. **NOTE:** A **SRS QMS300** is used to perform real-time MIMS determinations of alcohols in chloroform. RGAs are rapidly gaining acceptance in this field as their excellent price/performance value is realized by MIMS practitioners.

3. Raimo Ketola, et. al.,”Environmental applications of MIMS”, Journal of Mass Spectrometry 37 (2002) 457. **Note:** Excellent review article with tons of references and a list of published experiments sorted by analyte type and technique.

### Variable Leak Valves


2. R. A. Langley, et.al., “Gas injection system for the Advanced Toroidal Facility”, JVST A7 (1989) 2423. **Note:** An elastomer seal, with piezoelectric actuator valve is described.

Vacuum and Process Control Publications


3. **Vacuum.** The international journal Vacuum publishes high quality papers on latest advances in the many areas which now require the production and control of a working environment at pressure below one atmosphere. Published by Pergamon Press, a division of Elsevier Books and Journals: www.elsevier.nl.


6. **Semiconductor International.** Another monthly Cahners publication dedicated to semiconductor processing subjects. Available on the web: www.semiconductor.net

7. **Solid State Technology.** A monthly PennWell publication, available on-line: www.solid-state.com

8. **Micro.** A monthly Cannon Communications Publication that often deals with vacuum contamination issues. Available on-line: www.micromagazine.com. They have a deep article archive in their website where you can find most of the MICRO papers referenced here.

9. **FUTURE FAB International.** Published by Technology Publishing, Ltd. in the U. K., e-mail: tech@techpub.org.

10. **AVS Monograph Series.** The American Vacuum Society (AVS, www.vacuum.org) publishes a whole series of monographs on vacuum technology and processing subjects. They are all very good and worth checking out. Some of the books are required minimum reading for vacuum practitioners.
Vacuum and Process Control Websites

1. **www.vacuumlab.com**: An on-line “Journal of Useful and Practical Vacuum Technology”, published on-line by Phil Danielson. No advertisements, no product selling, just plain old vacuum knowledge. We highly recommend it. It even includes an “Ask Phil” section where you can submit any of those vacuum questions that have puzzled you in the past. We encourage you to challenge Phil! At this point the website is completely free and open to the general public.

2. **www.thinkSRS.com**: The SRS website is packed with very useful application notes related to vacuum applications and instrumentation. Check it out! We are constantly adding new notes to our list of applications.
Last update: 9/26/2003