Vacuum Technology
Room: 230B - Session VT-MoA

Extreme High Vacuum
Moderator: Martin Wüest, INFICON Ltd., Liechtenstein, Jay Hendricks, NIST

2:20pm **VT-MoA1 An XHV Standard: Making Absolute Measurements in the UHV and XHV**, ***James A. Fedchak***, *J. Scherschligt, M.S. Sefa*, National Institute of Standards and Technology (NIST)

Ultra-high vacuum (UHV) and extreme-high vacuum (XHV) underpins much of the manufacturing and research found in today's high-tech products and advanced research programs. Several National Metrology Institutes have high-vacuum standards that allow the calibration of vacuum gauges and mass spectrometers down to 10^{-8} torr, but few have capabilities to perform absolute calibrations in the UHV and below. To date, most vacuum standards utilize the dynamic expansion technique. Low vacuum pressure is realized by scaling down a known high pressure to a low pressure region via an orifice with well-characterized dimensions . Although these standards are often described as being "primary", these standards are not, in fact, either primary or fundamental. Here, we describe NIST's efforts to build a UHV/XHV standard covering the pressure range from 10^{-8} torr to 10^{-12} torr. We will pose and propose and answer to the question: Is it possible to build an absolute vacuum sensor that is also a primary standard in the UHV and XHV?

2:40pm **VT-MoA2 Reducing the Ultimate Pressure of Turbo Pumps for XHV Applications**, ***Julia Scherschligt***, *J. Fedchak, M.S. Sefa*, NIST

Typically NEG or ion pumps are used to achieve XHV pressures, but these are unsuitable for our application because they're gas specific. Turbo pumps can pump all gases, but the ultimate pressure for a common turbo pump is dominated by outgassing and is in the range of about 10^{-10} torr. We investigate reducing the ultimate pressure of a turbo pump for XHV applications.

3:00pm **VT-MoA3 XHV Cryopump Performance and Limitations for the Jefferson Lab Polarized Electron Source**, ***Marcy Stutzman***, *P.A. Adderley, M. Poelker*, Thomas Jefferson National Accelerator Facility

Cryopumps are typically limited to pressures above 1x10^-10 Torr. This is partly due to the lower pump speeds for hydrogen and other light gasses that dominate systems approaching XHV. Additionally, the cryosorbers and adhesives in cryopumps are typically not compatible with the bakeouts of systems used to reduce water vapor pressure in XHV systems. A series of investigations will be described using a commercial XHV cryopump from Leybold, both alone and with the NEG and ion pumps typically used in the Jefferson Lab electron source. The benefits and limitations of using this cryopump for our applications will be examined.

3:20pm **VT-MoA4 A Comparison of Reduced Outgassing Rates for Air-Baked and Vacuum-Baked Stainless Steel Vacuum Chambers**, ***Makfir Sefa***, *J. Fedchak, J. Scherschligt*, National Institute of Standards and Technology (NIST)

Stainless steel is the most common metal used in the construction for ultrahigh vacuum (UHV) and extremely high vacuum (XHV) chambers. Hydrogen outgassing from the chamber walls is the predominant residual gas and it limits the lowest attainable pressure level in vacuum systems. There are several methods for reducing hydrogen outgassing rates from stainless steel chamber walls. High temperature ($T > 400$ °C) heat treatments are typically used to remove hydrogen from the bulk material and reduce outgassing. In this work, a comparison of reduced outgassing rates for high temperature air-baked and vacuum-baked stainless steel chambers is presented. We also will describe a simple apparatus that allowed us to directly compere outgassing rates from two different heat treatment methods.

4:00pm **VT-MoA6 Deposition of Non-Evaporative Getters (NEG) in Very Narrow Chambers**, ***Andre Anders***, *X. Zhou, Y. Yang, C. Swenson*, Lawrence Berkeley National Laboratory

Several next-generation accelerators require much narrower beam pipes than in the past in order to gain better control of beam position and shape. For example, diffraction-limited synchrotrons currently under construction or in the design phase call for vacuum chambers as narrow as 4 mm at certain sections. For such narrow chambers, the vacuum conductance is greatly reduced making it difficult to reach the ultrahigh vacuum requirements that are customarily required for accelerators. The solution seems clear: the beam pipes and other vacuum components have to be the pump. Non-evaporative getters (NEG) coatings are the straight-forward answer to these challenges. In this contribution we report about progress to coat very narrow vacuum chambers with NEG coatings using pulsed sputtering techniques at relatively high process gas pressures. We discuss deposition rates, film composition, various issues encountered and initial tests of pumping performance.

This work was supported by the Laboratory Directed Research and Development Program of Lawrence Berkeley National Laboratory under U.S. Department of Energy Contract No. DE-AC02-05CH11231.

Authors Index

Bold page numbers indicate the presenter

— A —

Adderley, P.A.: VT-MoA3, 1
Anders, A.: VT-MoA6, **1**

— F —

Fedchak, J.: VT-MoA1, **1**; VT-MoA2, 1; VT-MoA4, 1

— P —

Poelker, M.: VT-MoA3, 1

— S —

Scherschligt, J.: VT-MoA1, 1; VT-MoA2, **1**; VT-MoA4, 1
Sefa, M.S.: VT-MoA1, 1; VT-MoA2, 1; VT-MoA4, **1**
Stutzman, M.L.: VT-MoA3, **1**
Swenson, C.: VT-MoA6, 1

— Y —

Yang, Y.: VT-MoA6, 1

— Z —

Zhou, X.: VT-MoA6, 1