



Maintaining Ultra High Pure Gas Delivery Systems by installing Pall Gas Filter Assemblies

Anthony Ricci

The current state of the art semiconductor technology requires a much higher level of contamination control. Contamination in Ultra High Purity (UHP) gas delivery systems must be kept at a minimum in order to achieve smaller feature geometries and faster device performance. As a result of this, gas filter assemblies must not only be able to remove particulate contamination larger than 3 nm with very high efficiency, but also not outgas any appreciable molecular contamination in order to maintain consistent purity levels within gas delivery systems.

Outgassing can be caused by the release of atmospheric gasses that are adsorbed to or entrapped within the materials of construction of the gas filter. This molecular contamination can come into contact with the gas filter assembly materials during molding or machining of the materials, storage, cleaning, and handling. The initial pulsed flow of process gas, elevated temperatures, and low vacuum pressures can trigger outgassing of the gas filter assembly. Long “dry down” times of the gas filter assembly can be expected depending on the severity of outgassing, which can lead to delays in the manufacturing process.

Pall filter media outgassing characteristics

Outgassing characteristics of an all metal filter (Ultramet-L® assembly) and a PTFE membrane

filter (Gaskleen® assembly) were determined using a vacuum chamber in a gas delivery system.^{1, 2} Each filter was separately installed upstream of a bellows valve. The valve was held open for 30 minutes, with the time to reach 5 mtorr recorded, as well as the pressure achieved at the end of the 30 minute period. Outgassed water and oxygen from the gas filter assemblies were analyzed using a mass spectrometer.

The test data in Table I indicates that Pall Ultramet-L and Gaskleen filter assemblies are constructed to eliminate any significant amount of water and oxygen contamination from outgassing into gas delivery systems. In addition, the insignificant outgassing from the filter assemblies enables fast pump down times of the vacuum chamber. This translates to faster process cycle times.

Outgassing characteristics^{3,4,5} of Pall Membralox® filter assemblies with ceramic medium were determined at an independent lab, while outgassing characteristics of Pall Ultramet-L filter assemblies with nickel medium (part number SGLFN3602VMM4) were conducted at Pall Scientific and Laboratory Services (SLS). The testing consisted of flowing dry nitrogen through the filter assemblies while measuring moisture, oxygen, and THC contamination over time. The test data indicates that the Membralox

Table I. Vacuum chamber pump-down time and outgassing test data obtained using Pall Ultramet-L and Gaskleen assemblies.

Test	316L SS medium	PTFE medium
Pump Down time to 5mT (min.)	2.4	20
Vacuum after 30 min.pump down (mT)	0.6	4.0
Average Outgassing Rates of water & oxygen (µmoles/min.)	0.0000083	0.019

filter assemblies with ceramic medium and Ultramet-L filter assemblies with nickel medium contribute <10 ppb of moisture (measured per SEMASPEC #90120397B-STD), <10 ppb of oxygen (measured per SEMASPEC #90120398B-STD), and <10 ppb total hydrocarbons (THC) (measured per SEMASPEC #90120396B-STD) in the allowable time limit.

In summary, Pall gas filter assemblies with 316L stainless steel, PTFE, ceramic, and nickel media are constructed to eliminate any significant amount of molecular contamination from outgassing into UHP gas delivery systems. This assures the maintenance of consistent purity levels within gas delivery system. Filter assembly low outgassing rates enable rapid pump down times of process tools.

References

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Gas Filtration Assemblies-Metal A84a
Ultramet-L™ Nickel 3600 Series Assembly

Gas Filtration Assemblies-Ceramic A85a
Membralox® Filter Assemblies

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Pall Corporation


2200 Northern Boulevard
East Hills, New York 11548-1289 USA

1.800.360.7255 toll free (Only in US)
1.516.484.5400 phone
1.516.625.3610 fax

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ABG-107-0405