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# Improved Pump Down Time with Evactron® Turbo Plasma™ Cleaning

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As the need for higher throughput of samples in Scanning Electron Microscopes (SEMs) and Focused Ion Beam (FIB) systems increases, so does the necessity to shorten pump down times between loading samples. Industry demands SEM/FIB systems to be operational 24/7 and ideally maintained in pristine condition with uncompromised image quality. Frequent venting of the SEMs or FIBs to load samples introduces moisture and contamination into the vacuum chamber, leading to much longer pump down times and decreased efficiency.

The new Evactron Turbo Plasma™ De-Contaminators remove hydrocarbon (HC) contamination [1] from SEMs, FIBs and other analytical tools using a gentle, down-stream plasma afterglow process. At turbo pump pressures, Evactron cleaning becomes faster and spreads throughout the chamber. This is due to longer mean-free-paths that cause less recombination of oxygen radicals in the required three body collisions and decreased scattering to chamber walls [1]. In most cases, short plasma cleaning cycles are sufficient to remove contamination and significantly shorten pump down time, allowing for high throughput of sample processing and analysis.

To demonstrate the effect of Evactron Turbo Plasma Cleaning on pump down time and HC contamination removal, the study was done using an EP model Evactron Plasma De-Contaminator on a large, highly oil-contaminated 50 L vacuum chamber equipped with a 450 L/sec turbo molecular pump, 14 CFM scroll pump, MKS 972B dual range pressure gauge and a residual gas analyzer (RGA). Evactron Cleaning was done at 20 Watts for 30 minutes. RGA spectra (Fig. 1 and 2) and pump down curves (Fig. 3) were obtained before and after contamination and plasma cleaning in order to demonstrate the effects of Evactron Turbo Plasma cleaning on pump down time and hydrocarbon removal. The chamber is considered to be in pristine condition when the HC peaks on the RGA spectrum were less than a partial pressure of 2 X $1^{-10}$ Torr.

The length of the pump down time shows dependence on hydrocarbon contamination levels [2] in SEMs and FIBs. Therefore, this time could be used as an indicator of the cleanliness of the vacuum system. The data shows that Evactron plasma cleaners significantly reduce both the pump down time of the SEMs and FIBs as well as hydrocarbon contamination, and thus help increase sample processing throughput without compromising the quality of analysis.

Typically, vacuum chambers can be cleaned with the Turbo Plasma Cleaning process at turbo molecular pressures of $10^{-2}$ to $10^{-3}$ Torr with typical cleaning times of 2 - 10 minutes to maintain pristine conditions, and returning to typical operating pressures in < 20 minutes. Current users of Evactron Plasma Cleaners report significant reduction in pump down time after using Evactron De-Contaminators as well as easier maintenance of the pristine state of cleanliness of their SEMs and FIBs. A more detailed analysis and data from multiple experiments will be presented.

**References:**

[1] Vane, R. (2013). *Microsc. Microanal.* 19(2), 1338.
[2] Kobayashi, H. (2010). *J. Phy. So. JPN,* 53(10), 568-572.

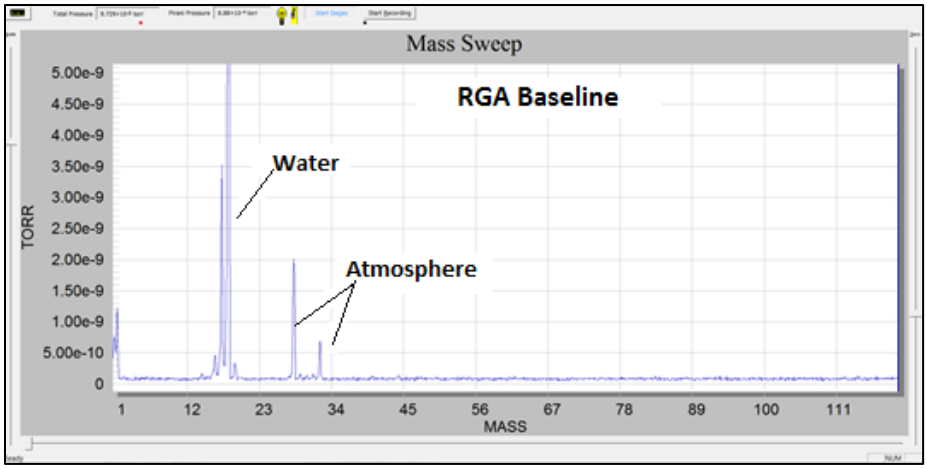


**Figure 1.** RGA baseline of "Pristine" chamber (clean environment).

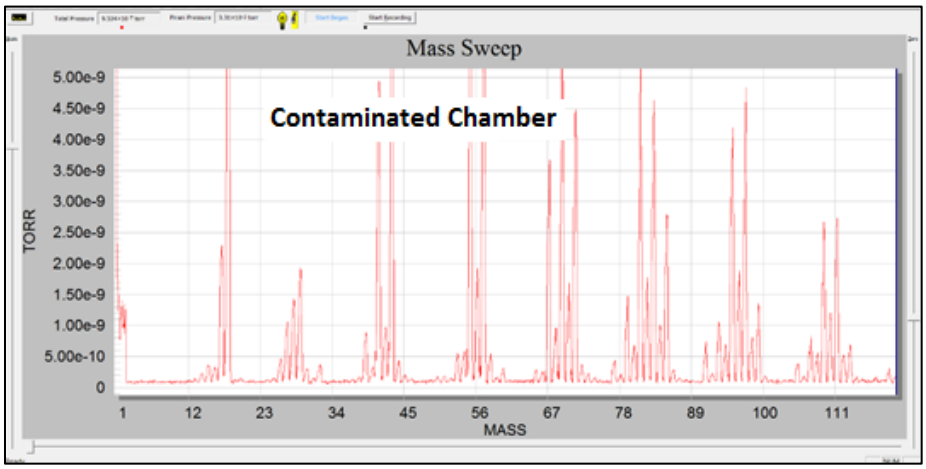


**Figure 2.** RGA of the HC contaminated chamber.

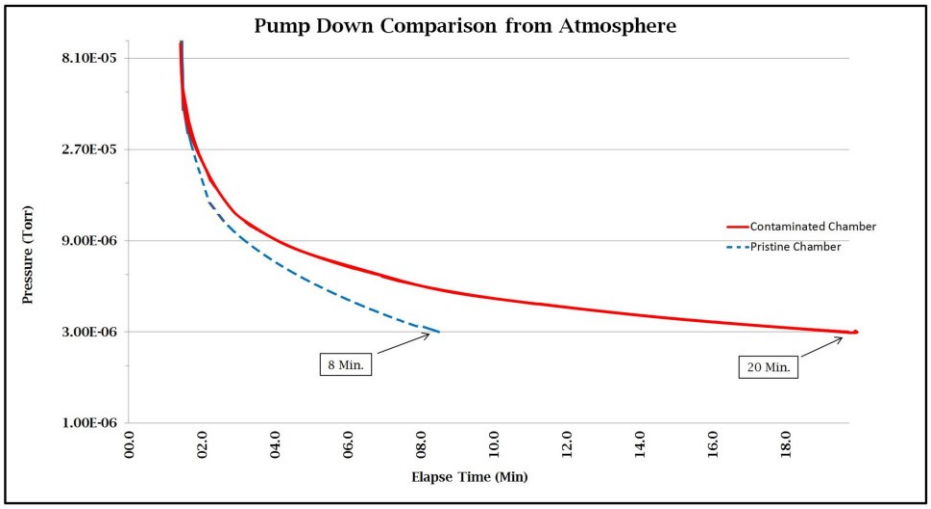


**Figure 3.** Comparison of the pump down time from atmosphere between the HC contaminated chamber and the "pristine" chamber after Evactron® cleaning.

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