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# A Study of the Cleaning Effectiveness of the Evactron® RF Plasma System on a Scanning Electron Microscope

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An anti-contamination RF plasma cleaning system designed to remove hydrocarbon contamination from a vacuum chamber has been developed by XEI Scientific and given the trade name Evactron®. One of the primary applications of the RF plasma cleaning system is to reduce or eliminate electron beam induced contamination growth in scanning electron microscopes (SEM) for better analysis, identification, and metrology (Ref. 1). The system is an externally mounted remote plasma system that provides both oxidative cleaning of SEM chambers and in-situ cleaning of SEM specimens.

The RF plasma cleaning system can be mounted directly on any specimen chamber port. Air or oxygen is introduced through the system to maintain a low-power RF glow-discharge which in turn produces oxygen radicals that flow out of the plasma into the specimen chamber via convection. The oxygen radicals react with hydrocarbons on all exposed surfaces to form CO, $H_2O$, and $CO_2$ molecules that are removed via the roughing pump. The plasma itself is confined to the Evactron® chamber, eliminating the possibility of ion and electron bombardment damage to the instrument, specimen, or x-ray window of an Energy Dispersive Spectroscopy (EDS) system (Ref. 2).

The Evactron® was installed and utilized on a variety of SEM's. The types of SEM's represented in this study include a conventional SEM, a variable pressure SEM and a cold field emission SEM. Two of these SEM's had EDS x-ray systems on them and one had an EBIC system as well CL system. In this work, the RF plasma anti-contamination system was mounted on a Hitachi S-3200N SEM (Fig. 1), a Hitachi S-2500 SEM and a JEOL 6400F. The RF plasma system was operated successfully on each of these microscopes with a range of sample types. In all cases the Evactron® was utilized for the reduction and/or removal of beam induced contamination for a wide variety of specimens and imaging/analysis conditions.

[1] N. Sullivan et al., 'A Study of the Effectiveness of the Removal of Hydrocarbon Contamination by Oxidative Cleaning Inside the SEM', Microscopy and Microanalysis 2002, (Quebec City, Quebec, Canada).
[2] R. Vane et al., 'A Study of the Effects of Evactron® Plasma Cleaning on X-ray Windows', Microscopy and Microanalysis 2004, (Savannah, GA).

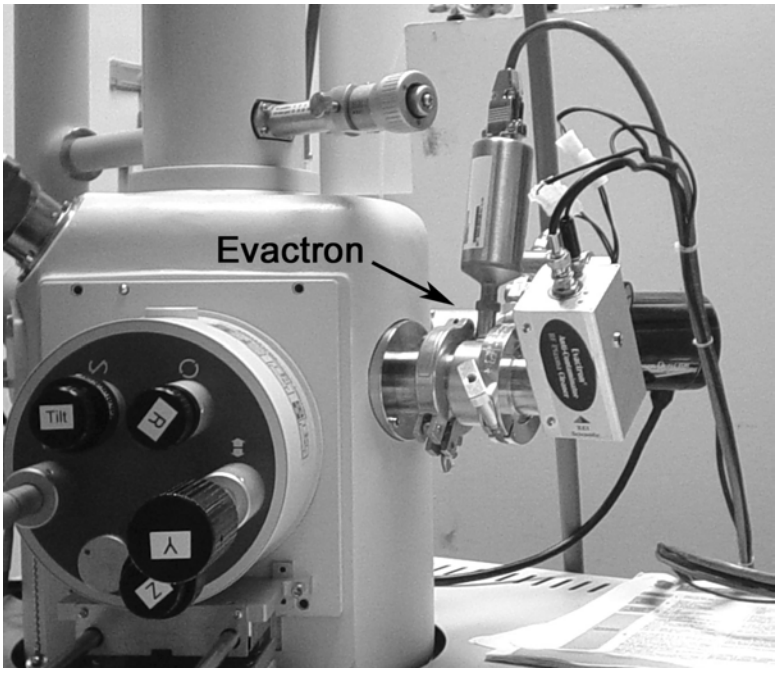


**Fig. 1** The Evactron® anti-contamination system mounted on an auxiliary port of the environmental Hitachi S-3200N SEM.

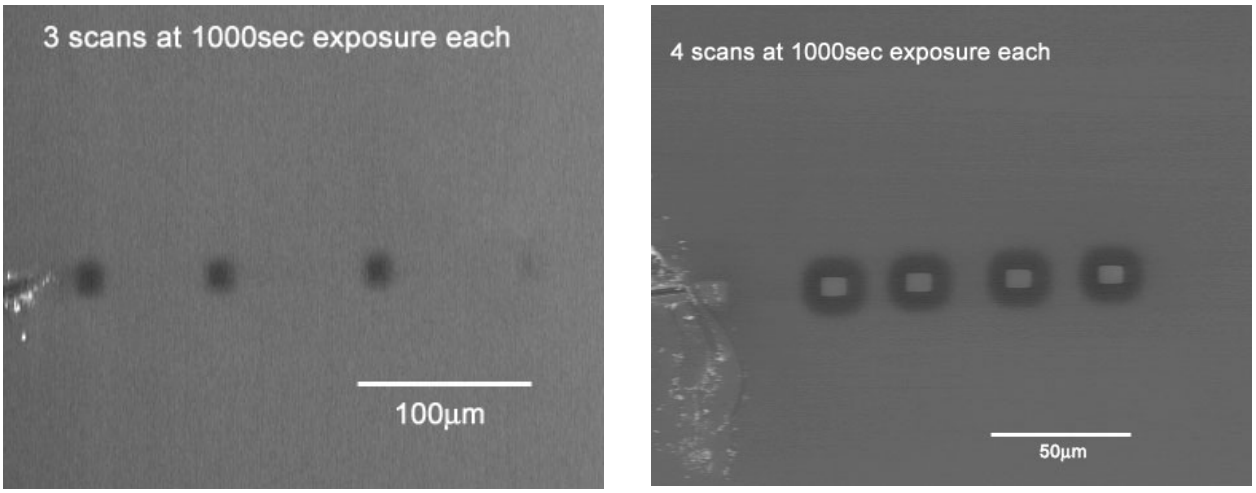


**Fig. 2** SEM images of (a) contamination deposition prior to chamber cleaning and (b) reduction of contamination deposition after chamber cleaning for 15 minutes. Exposures were performed with a 12 nA, 30 kV electron beam.

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