

MODEL 1020

Plasma Cleaner

Effectively cleans specimens
for electron microscopy





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Cleans specimens immediately before they are inserted into the electron microscope; removes existing carbonaceous debris from the specimen and prevents contamination from occurring during imaging and analysis.

- **Simultaneously cleans specimen and specimen holder**
- **Cleans highly contaminated specimens in 2 minutes or less**
- **No change to the specimen's elemental composition or structural characteristics**
- **Oil-free vacuum system**
- **Easy-to-use front panel controls**
- **Readily accepts side-entry specimen holders for all commercial transmission electron microscopes (TEMs) and scanning transmission electron microscopes (STEMs)**
- **For scanning electron microscopy (SEM), as well as other surface science techniques**
- **Handy for evacuating specimen holder vacuum storage containers**

CONTAMINATION SOURCES

Contamination typically comes from several sources: inadvertent touching of specimens or specimen holders, backstreaming of oil from an oil diffusion pumped ion milling system, electron microscope column contamination, and adhesives or solvents used in the preparation process. Even when great care is taken to clean the specimen, standard cleaning methods are often not 100% successful.

Electron microscopy demands clean specimens

Clean, well-prepared specimens are imperative for imaging and microanalysis in electron microscopy. TEM analysis requires that specimens be prepared without altering their microstructure or composition. Modern electron microscopes with high brightness electron sources such as LaB₆ filaments and field emission guns combine a small electron probe for microanalysis with increased beam current density, yielding high-resolution images, as well as enhanced analytical data. Unfortunately, as probe size decreases and beam current density increases, specimens tend to become contaminated. As a result, the quality of the specimen and the cleanliness of both the specimen and the specimen holder are more important than ever.

The Model 1020 Plasma Cleaner cleans specimens immediately before they are inserted into the electron microscope. Plasma cleaning removes existing carbonaceous debris from the specimen and prevents contamination from occurring during imaging and analysis. A low-energy, inductively coupled, high-frequency plasma effectively cleans a specimen surface without changing its elemental composition or structural characteristics. Highly contaminated specimens can be cleaned in 2 minutes or less. The plasma cleaner readily accepts side-entry specimen holders for all commercial TEMs and STEMs and can accept bulk specimens for cleaning before SEM or surface analysis.

Clean specimens and holders

The plasma cleaner removes contamination from a wide variety of materials prepared by a variety of techniques. The plasma chamber configuration makes it possible to clean specimen holders for any commercially available TEM or STEM. The specimen holder is inserted through a single port into the plasma chamber. The port contains a vacuum-sealing surface compatible with the specimen holder's O-ring.

PLASMA CLEANING

In a nonequilibrium, high-frequency plasma, free electrons are accelerated to high velocities by an oscillating electromagnetic field that excites gas atoms and creates the plasma. The plasma ions impinge upon the surface with energies of less than 12 eV, which is below the specimen's sputtering threshold.

Cleaning occurs when reactive gas compounds formed by the plasma chemically react with carbonaceous material on the specimen and holder.

Fischione recommends a mixture of 25% oxygen and 75% argon to optimize cleaning. An oxygen plasma is highly effective in removing organic (hydrocarbon) contamination. The reaction yields H₂O, CO, and CO₂, which are evacuated by the vacuum system.

Ports are available for side entry specimen holders for electron microscopes manufactured by:

- FEI Company/Philips Electron Optics
- Hitachi High Technologies America Inc.
- JEOL Ltd.
- Carl Zeiss Microscopy/LEO Electron Microscopes
- Topcon Corp.

Ports are easily interchangeable without tools in as little as 10 seconds.

For cleaning specimens containing significant amounts of carbon or specimens mounted onto carbon support grids, shielded specimen holder ports are available that optimize the cleaning action of the plasma.

The large-diameter plasma chamber and specially designed holders accommodate bulk specimens for SEM, as well as other surface science techniques. Likewise, aperture strips, specimen clamping rings, and SEM specimen holders can be cleaned.

Imaging with confidence

Plasma cleaning is an essential final step in the preparation of specimens for electron microscopy. Use the plasma cleaner to be confident that carbonaceous contamination will not interfere with imaging or analysis, even during fine probe microanalysis for extended periods.

Plasma chamber

The plasma is created in a cylindrical chamber made of quartz and stainless steel. Sophisticated gas dynamics ensure that the plasma is evenly distributed within the chamber to clean the specimen with negligible heating. A high-frequency antenna, located outside the chamber, couples the oscillating field to the chamber. None of the instrument's components are located within the chamber.

Vacuum system

The plasma cleaner's oil-free vacuum system consists of a turbomolecular drag pump and a multistage diaphragm pump; this is an ideal combination of pumps for establishing suitable vacuum characteristics to activate and sustain the plasma. Rapid chamber pump-down times allow plasma cleaning to begin almost immediately after a specimen is inserted.

The plasma cleaner can also evacuate individual specimen holder Vacuum Storage Containers and cryo transfer TEM specimen holder dewars.



Typical TEM specimen holder port



Shielded specimen holder port



Multiple specimen holder; SEM stubs



Clamp-grip holder for retaining bulk materials



Multiple specimen holder for TEM specimens

Power supply

The high-frequency (13.56 MHz) oscillating power supply initiates and sustains a low-energy, inductively coupled plasma. A matching network couples the high-frequency field to the plasma chamber and ensures compatibility with specimen holders produced for diverse TEMs. Shielding prevents the emission of high-frequency interference and complies with U.S. Federal Communications Commission guidelines.

Front panel controls

The control panel is easy to use. Dedicated keys control the vacuum pumping and venting sequence. LEDs indicate when the system is venting, at atmospheric pressure, pumping, and has achieved a high vacuum condition.

When the chamber is the appropriate state for cleaning and the cleaning parameters are entered, the plasma is automatically activated. The control panel displays the remaining processing time. Cleaning ends automatically when the specified time has elapsed.

Easy access to services

A service panel located on the front of the instrument's enclosure provides access to a potentiometer, which controls the gas flow metering valve, the high-frequency power control, and function switches used for diagnostic purposes. Displays indicate the vacuum level and an hour meter tracks the vacuum system's total operating time so that routine maintenance can be scheduled accordingly.

Optional accessories

Model 9010 Vacuum Storage Container

After plasma cleaning, insert specimen holders into the optional Fischione Instruments Model 9010 Vacuum Storage Container so that they can be stored or transported in a vacuum. A sight glass gives a clear view of the specimen area of the specimen holder.

Model 9020 Vacuum Pumping Station

The Vacuum Pumping Station stores up to five specimen holders under vacuum. It includes a heavy-duty metal base with non-skid feet, five independently valved Vacuum Storage Containers, a vacuum pumping manifold, and all necessary components for connecting to the Model 1020 Plasma Cleaner.



Model 1020 Plasma Cleaner control panel



Model 9010 Vacuum Storage Container



Model 9020 Vacuum Pumping Station installed on a Model 1020 Plasma Cleaner



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