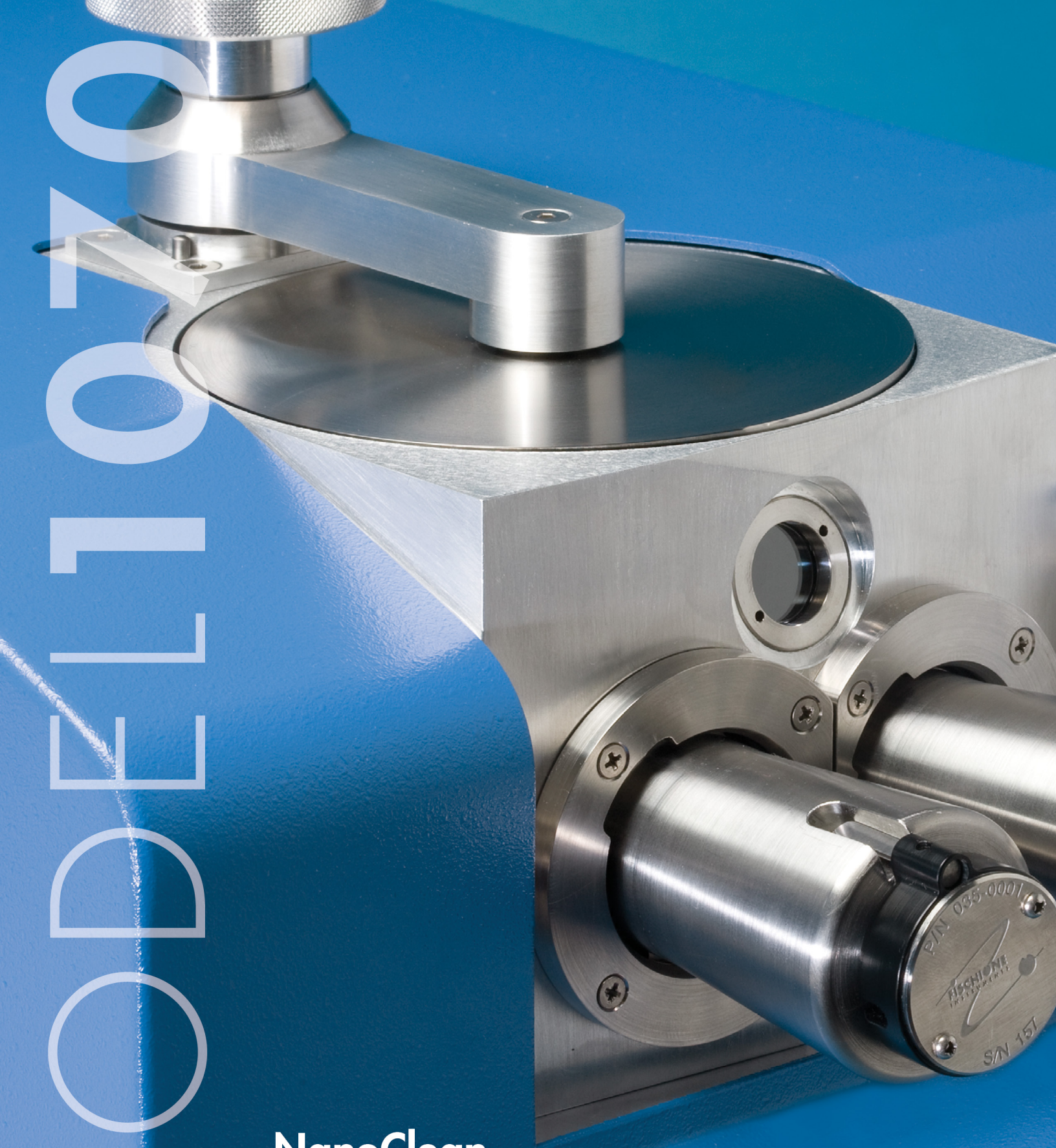
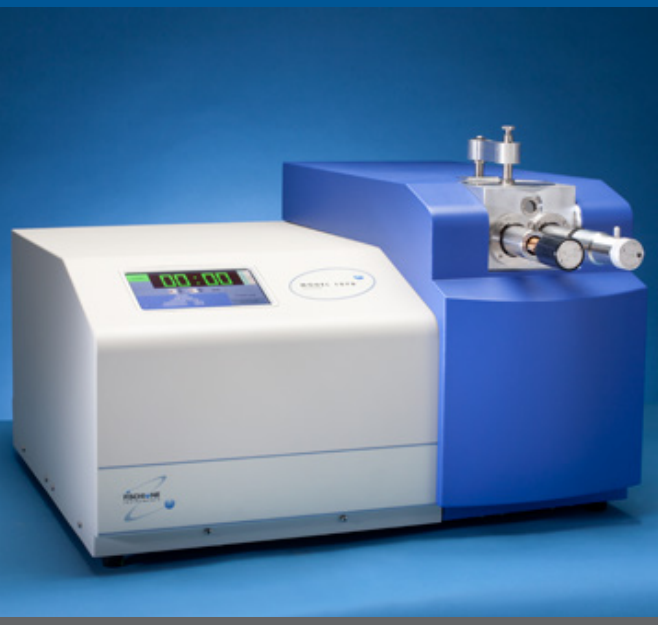
MODEL 1070



NanoClean

Effectively cleans specimens, holders, grids, and bulk objects for electron microscopy and many other applications

FISCHIONE INSTRUMENTS



MODEL **1070**

NanoClean

Cleans specimens and holders immediately before insertion into an electron microscope; removes existing carbonaceous debris from the specimen and prevents contamination during imaging and analysis.

- **Multifunctional; simultaneously cleans specimens, specimen holders, and stubs**
- **Inductively coupled, downstream plasma for optimal performance**
- **Sputter-free; no change to elemental composition or structural characteristics**
- **Accepts two electron microscopy specimen holders**
- **Compatible with side-entry holders for all commercial scanning, transmission, and scanning transmission electron microscopes**
- **Accommodates large objects**
- **Multiple gas inlets with mixing capabilities**
- **High frequency power with automatic matching network**
- **Simple setup with touchscreen interface**
- **Handy for evacuating vacuum storage containers**

CLEAN LARGE OBJECTS AND GRIDS

In addition to traditional electron microscopy applications, many other objects can benefit from plasma processing. Larger objects, such as pieces of semiconductor wafers or scanning electron microscopy (SEM), atomic force microscopy (ATM), or secondary ion mass spectrometry (SIMS) holders can also be cleaned.

For biological transmission electron microscopy (TEM) applications, grids can be subjected to the plasma to promote hydrophilic wetting.

Electron microscopy demands clean specimens and holders

Clean, well prepared specimens are imperative for imaging and microanalysis in electron microscopy. TEM requires that specimens be prepared without altering their microstructure or composition.

Modern electron microscopes with high brightness electron sources such as LaB_6 filaments and field emission guns (FEG) use a small electron probe with high beam current for microanalysis, yielding high-resolution images as well as enhanced analytical data. As probe size decreases and beam current density increases, specimens tend to become easily 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.

Contamination typically comes from several sources: inadvertent touching of specimens or specimen holders, 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 completely successful.

Model 1070 NanoClean for electron microscopy applications

The Fischione Model 1070 NanoClean cleans specimens and holders immediately before they are inserted into an electron microscope. Plasma cleaning both removes existing carbonaceous debris from the specimen and prevents contamination during imaging and analysis.

A low-energy, inductively coupled, high frequency, downstream plasma effectively cleans the specimen surface without changing its elemental composition or structural characteristics. Highly contaminated specimens can be cleaned in two minutes or less.

The NanoClean readily accepts one or two side-entry specimen holders for all commercial TEMs and scanning transmission electron microscopes (STEMs), and can accept bulk specimens for cleaning before conducting SEM or surface science analysis.

PLASMA CLEANING

In a nonequilibrium, high-frequency plasma, free electrons are accelerated to high velocities by an oscillating electromagnetic field and collide with gas atoms, forming ions and sustaining 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 specimen holder.

Fischione recommends a mixture of 25% oxygen and 75% argon to optimize cleaning (other gases or mixtures can also be used). An oxygen plasma is highly effective in removing organic (hydrocarbon) contamination. The reaction yields H_2O, CO, and CO_2, which are evacuated by the vacuum system.

Cleaning specimens and holders

The NanoClean removes contamination from a wide variety of materials prepared by a variety of techniques. The specimen holder is inserted through a port into the plasma chamber. The port contains a vacuum-sealing surface compatible with the specimen holder's O-ring.

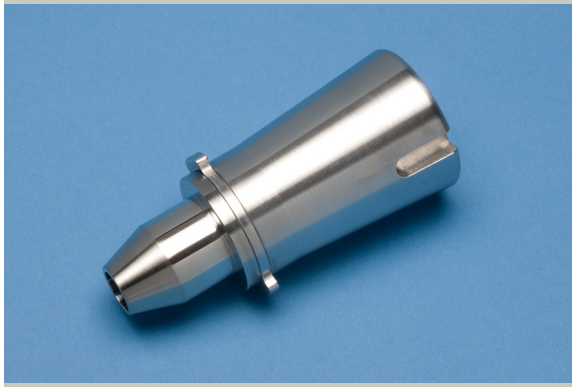
The chamber is configured to accept one or two specimen holder ports. Ports are available for side

entry specimen holders for electron microscopes manufactured by:

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

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

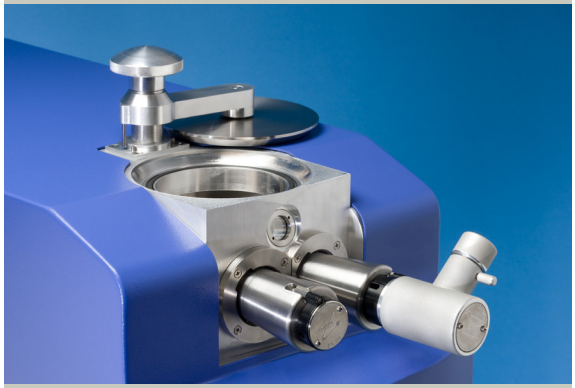
For cleaning specimens containing significant amounts of carbon or specimens mounted onto carbon support grids, shielded specimen holder ports are available that optimize the cleaning rate of the plasma.



Typical TEM specimen holder port

Imaging with confidence

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



Model 1070 NanoClean with chamber lid open

Plasma cleaning for SEM (EDX)

The benefits of plasma cleaning are not only for TEM but also for bulk specimens, which can be readily introduced through the chamber's top port. Specimens for SEM and surface analysis can be cleaned as well as specimen holders, aperture strips, tweezers, specimen clamping rings, and anything else that can be placed into the plasma chamber.

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, inductively couples the oscillating electromagnetic power to the process gas contained in the chamber. None of the instrument's components are located within the chamber.

Receptacles on the front surface of the chamber can accept two ports for standard electron microscopy specimen holders. A view port provides the ability to observe the inside of the chamber. A lid on top of the chamber allows larger objects to be placed into the plasma.

Vacuum system

An oil-free vacuum system is essential to prevent contamination. The vacuum system for the NanoClean consists of a turbomolecular drag pump and a multistage diaphragm pump, an ideal combination for establishing suitable vacuum characteristics to activate and sustain the plasma. The vacuum level is measured by a Pirani gauge.

The chamber includes a load lock for rapid specimen exchange which allows plasma cleaning to begin almost immediately after a specimen is inserted. An electronically actuated gate valve isolates the plasma chamber from the vacuum system. Pump down time for the chamber is less than 50 seconds. Also, the chamber can be vented within 5 seconds after the conclusion of plasma processing. These features make the NanoClean ideal for high-throughput applications.

The NanoClean can also be used to evacuate individual specimen holder vacuum storage containers and cyrotransfer TEM specimen holder dewars.

A port plug inserted into the specimen holder port seals the chamber under vacuum when the instrument is not in use.

Power supply

The high frequency (13.56 MHz) oscillating power supply is used to initiate and sustain a low-energy, inductively coupled plasma (ICP). An ICP is ideal for microscopy applications since it delivers ions with energy low enough that the specimen's properties are not altered.

An automatic matching network ensures that the high frequency power is effectively coupled to the plasma and the delivered power is suited for the application. The matching network regulates plasma power for a variety of conditions, objects to be processed, or gases employed. It also guarantees plasma compatibility with specimen holders produced for diverse electron microscopes.

Effective shielding prevents high frequency interference and fully complies with FCC guidelines.

Process gas

The NanoClean contains three mass flow controllers and is designed to accept multiple gases. Typically, the time-proven gas mixture of 25% oxygen and 75% argon is connected to one of the gas inlets. The NanoClean is fitted with two additional gas inlets which accept gas supplies that can be blended using the NanoClean's internal mass flow technology.

Instrument controls

An easy-to-use touchscreen embedded module allows you to control individual instrument functions, such as delivered power, chamber pressure, gas mixture, and process time.

For dedicated cleaning of electron microscopy specimens and holders, the NanoClean includes a recipe that yields optimal plasma processing conditions. All the user needs to do is insert the specimen holder into the specimen holder port and establish the process time. The instrument automatically controls the vacuum, supplies the appropriate power and gas flow, and energizes the plasma.

Recipes are stored for applications such as enhancing the hydrophilic properties of biological support grids. Custom recipes to set up a unique set of operating conditions can be created and stored by using the touchscreen.

The display provides a real-time representation of the instrument's key parameters including the remaining processing time.

Cleaning terminates automatically when the specified time has elapsed. A visual indicator notifies the user that plasma cleaning is complete. The specimen remains under vacuum until the user initiates the venting process.

Maintenance

The NanoClean enclosure has been designed for ease of service.

When connected to the Internet, the NanoClean can be accessed remotely for diagnostic purposes.

Software tracks the vacuum system's total operating time so that routine maintenance can be scheduled.

Model 9010
Vacuum Storage
Container

Model 9020
Vacuum Pumping Station

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 5 specimen holders under vacuum. It includes a heavy-duty metal base with non-skid feet, 5 independently valved Vacuum Storage Containers, a vacuum pumping manifold, and all necessary components for connecting to the Model 1020 Plasma Cleaner.

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