

# Specimen preparation devices, specimen holders, and imaging detectors for electron microscopy



## Ion beam preparation



### MODEL 1080 PicoMill® TEM specimen preparation system

Combines an ultra-low energy, inert gas ion source, and a scanning electron column with multiple detectors to yield optimal TEM specimens.

- Achieve ultimate specimen quality – free from amorphous and implanted layers
- Complements FIB technology
- Milling without introduction of artifacts
- Advanced detector technology for imaging and precise endpoint detection
- In situ imaging with ions and electrons
- Microscope connectivity for risk-free specimen handling
- Adds capability and capacity
- Fast, reliable, and easy to use

### MODEL 1040 NanoMill® TEM Specimen Preparation System

Uses an ultra-low energy, concentrated ion beam to produce the highest quality specimens for transmission electron microscopy (TEM).

- Variable energy ion source generates ion energies as low as 50 eV and a beam size as small as 1  $\mu\text{m}$
- Ultra-low-energy, inert-gas ion source
- Removes damaged layers without redeposition
- Ideal for post-focused ion beam processing
- Enhances the results from conventionally prepared specimens
- Room temperature to cryogenically cooled NanoMilling<sup>SM</sup> process
- Rapid specimen exchange for high-throughput applications
- Computer-controlled, fully programmable, and easy to use
- Contamination-free, dry vacuum system



### MODEL 1050 TEM Mill

A state of the art ion milling and polishing system that consistently produces high-quality TEM specimens with large electron transparent areas.

- Two independently adjustable TrueFocus ion sources
- High energy operation for rapid milling; low energy operation for specimen polishing
- Ion source maintains a small beam diameter (100 eV to 6 keV operating energies)
- Continuously adjustable milling angle range of  $-10$  to  $+10^\circ$
- Liquid nitrogen-cooled specimen stage
- Basic and premium editions (premium edition shown at left)

### MODEL 1060 SEM Mill

A state of the art ion milling and polishing system. It is compact, precise, and consistently produces high-quality SEM samples for a wide variety of applications.

- Two independently adjustable TrueFocus ion sources
- High energy operation for rapid milling; low energy operation for sample polishing
- Adjustable beam diameters
- Continuously adjustable milling angle range of  $0$  to  $+10^\circ$
- Sample rocking or rotation
- Basic and premium editions (basic edition shown at right)



### MODEL 1063 WaferMill™ ion beam delayering solution

Full-wafer specimen preparation. With the WaferMill solution for CD-SEM specimen preparation, you can delayer multiple pre-selected regions on a full wafer. The entire process is automated; there is no need to manually touch a wafer.

- Selected-area milling on full 300 mm wafers
- Top-down delayering
- Expose multiple device layers and structures
- For use in multiple areas of a semiconductor fabrication facility:
  - Research and development
  - Process control
  - Yield enhancement
  - Failure analysis

## Contamination solutions



### MODEL 190 Cryo-Can

Eliminates sample contamination during SEM operation.

- Simple, economical, and reliable technique to remove organic contamination from the SEM
- The SEM can be used while the Cryo-Can is cooled, even on SEMs without airlocks
- Contaminants condense onto a removable, cold surface that can be regenerated and reused
- No separate vacuum or electrical interface required
- Noticeably improves resolution by reducing water vapor and hydrocarbons
- No internal cryo blade that restricts sample movement

### MODEL 1020 Plasma Cleaner

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
- Readily accepts side-entry specimen holders for all commercial TEM and scanning transmission electron microscopes (STEM)
- For SEM, as well as other surface science techniques
- Handy for evacuating specimen holder vacuum storage containers



### MODEL 1070 NanoClean

Removes existing carbonaceous debris from the specimen and holders; 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 SEM, TEM, and STEM
- Accommodates large objects
- Multiple gas inlets with mixing capabilities
- Handy for evacuating vacuum storage containers

### Model 9020 Vacuum Pumping Station

The Vacuum Pumping Station allows for the simultaneous vacuum storage of up to five plasma-cleaned specimens TEM specimen holders.

- Includes a heavy-duty metal base
- Five Model 9010 Vacuum Storage Containers
- A vacuum pumping manifold
- All of the necessary components for connection to the Model 1020 Plasma Cleaner.



## Imaging



### Model 3000 Annular Dark Field (ADF) Detector

Captures images formed by collecting electrons that have been forward scattered through high angles using high angle annular dark field STEM.

- Simultaneous high-angle annular dark field imaging and electron energy loss spectroscopy
- Yields Z-contrast information
- Single electron detection
- Fully retractable from beam path

## Conventional specimen preparation



### MODEL 110 Automatic Twin-Jet Electropolisher

Used for the electrolytic thinning of TEM specimens. The twin-jet technique simultaneously polishes both sides of the specimen, creating electron transparency within a few minutes.



### MODEL 130 Specimen Punch

Produces high-quality disk specimens from thin metal foils. A precision ground punch and die plate eliminate specimen stress and distortion.



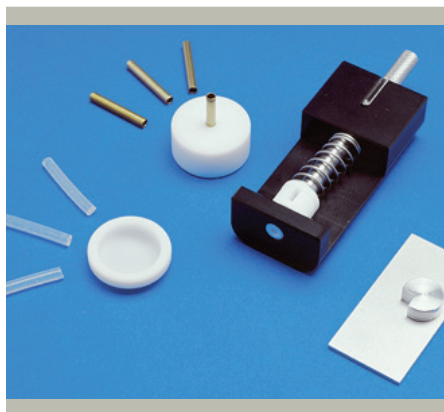
### MODEL 160 Specimen Grinder

Mechanically prethins specimens for TEM. Greatly reduces the time spent during the final preparation process of ion beam milling.



### MODEL 170 Ultrasonic Disk Cutter

Creates disk, cylindrical, and rectangular specimens; disk specimens from materials as thin as 10  $\mu\text{m}$ , rods up to 10 mm long, and rectangular wafers for TEM cross-section (XTEM) specimens.



### MODEL 180 XTEM Prep Kit

Includes all the components required to produce high-quality cross-section specimens for TEM. Stacks and holds cross-section specimens, aligns areas and interface of interest, and produces consistent glue layer thickness.



### MODEL 200 Dimpling Grinder

An easy to use, state of the art, mechanical thinning instrument designed for the reproducible preparation of high-quality electron microscopy specimens.

## Holders



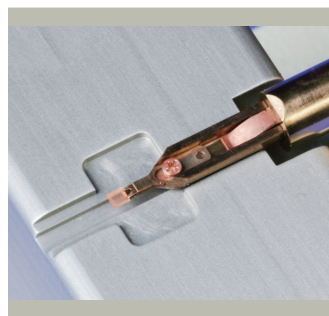
### MODEL 2020

**Advanced Tomography Holder**  
A revolutionary holder that allows room temperature data collection over wide tilt and translation ranges, even in restrictive pole-piece geometries.



### MODEL 2021

**Analytical Tomography Holder**  
Optimizes the acquisition of elemental composition and structural information in three dimensions. Beryllium tip and clamps reduce the addition of spurious or system radiation.



### MODEL 2030 Ultra-Narrow Gap Tomography Holder

Capable of tilting up to 90° while providing a maximized field of view for TEM.



### MODEL 2040

**Dual-Axis Tomography Holder**  
Features an optimal tilt angle range in narrow gap (~ 5 mm) pole-piece geometries while maintaining microscope resolution.



### MODEL 2045 Motorized Dual-Axis Tomography Holder

A holder that features an optimal tilt angle range in narrow gap (~ 5 mm) pole-piece geometries, while maintaining microscope resolution. Motorized rotational control for high throughput applications.



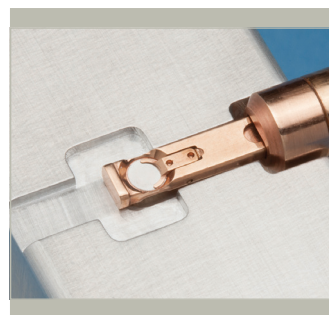
### MODEL 2050 On-Axis Rotation Tomography Holder

Accepts either rod- or cone-shaped specimens and rotates them fully through 360° about the axis of the holder.



### Model 2550 Cryo Transfer Tomography Holder

This single-tilt, liquid nitrogen-cooled, cryo transfer TEM specimen holder achieves a base temperature of better than -170 °C. Designed for cryo transfer and tomography of thin-film frozen-hydrated/vitrified specimens for low-dose imaging and analysis. The optional Model 9030 Turbo Pumping Station evacuates the dewar during zeolite regeneration.



### Model 2560 Vacuum Transfer Tomography Holder

The holder is ideal for sensitive specimens that can be altered by environmental conditions; the specimen can be transferred in the presence of vacuum or an inert gas environment.



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