Model 200

Dimpling Grinder

State-of-the-art mechanical grinder for preparing electron microscopy samples

EXCELLENCE...MAGNIFIED

Model 200 Dimpling Grinder

- ***Pre-thin for ion milling.***
- ***Polish to electron transparency.***
- ***Controlled grinding rate.***
- ***Precise indication of specimen thickness.***
- ***Easy programming.***
- ***Accepts mounted specimens from the Model 160 Specimen Grinder.***

The ultra-precise Model 200 Dimpling Grinder is indispensable when ion milling is used for final specimen thinning. Because the specimen is pre-thinned by dimpling, ion milling must remove only relatively small amounts of material. This creates specimens free from uneven thinning, surface defects, and irradiation damage.

Dimpling

High-quality specimens for transmission electron microscopy (TEM) need to have a large electron transparent area for analysis, but yet be rugged. One method that accomplishes both of these prerequisites is dimpling.

Dimpling is a rapid technique that involves simultaneously rotating the specimen about one axis and a grinding wheel about a perpendicular and intersecting axis. This combination of motions provides a specimen with its central area reduced to a thickness of a few microns.

By thinning only the central area of the specimen, a thick, rugged outer rim remains, eliminating the need for special handling techniques for fragile specimens. An abrasive slurry that is in contact with the grinding wheel and the specimen removes the material.

Versatile

By simply changing tools, the Model 200 can be used to flat grind bulk specimens, dimple, and then finally polish the specimen to electron transparency.

Precise specimen positioning

A key component of the Model 200 is the specimen stage that precisely rotates the specimen. The specimen is mounted with a low melting point polymer to the top half of a two-piece platen. The platen fits into a magnetic base, which is coupled to the specimen stage by a rare-earth magnet. This magnetic coupling allows the base to be positioned so that a particular area of the specimen can be precisely placed under the grinding wheel. Positioning can be observed through a 40X optical microscope.

The specimen can be readily removed for inspection and then precisely repositioned for continued grinding. Specimen rotation speed is continuously varied by a front panel mounted potentiometer.

Optimized grinding control

For effective preparation and to avoid specimen damage, an electromechanical stage lowers the grinding wheel at an optimized rate. This creates a very controlled reduction of specimen thickness. Wear on the grinding wheel is uniform, virtually eliminating

eccentric tool-induced vibration and ensuring grinding without the risk of specimen fracture.

At the conclusion of the grinding process, the advanced instrument control halts both the wheel and specimen rotation and then automatically lifts the grinding wheel from the specimen surface.

Vibration-free grinding

The precision fit of the grinding wheel to the shaft minimizes eccentricity. Both advanced rotary bearing technology and a specially designed drive system virtually eliminate wheel vibration. Grinding wheel rotation speed is continuously adjustable via a front panel mounted potentiometer.

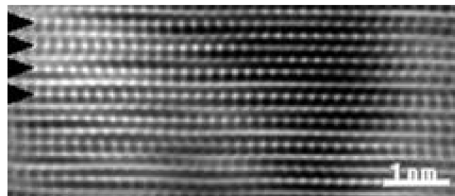
The Model 200 can incorporate different types of wheels:

- Grinding wheels for rapid material removal without scratching.
- Polishing wheels for an optimal surface finish.
- Wheels with different diameters for various dimple profiles.

A variety of wheel materials are available and can be specially matched to given applications.

Controlled grinding force and rate

The grinding wheel stage is pivoted to present the grinding wheel to the specimen. It contains a micrometer-type, adjustable counterweight system to regulate the applied grinding force. Because both grinding force and grinding rate are controlled, specimens with exceptional quality are produced.



Fourier filtered HRTEM image of a Co/Ru artificial superlattice obtained from a dimple ground XTEM specimen. The specimen was subsequently argon ion milled at a voltage of 4kV, a current of 4mA, and an incident milling angle of 7°. The specimen was cooled to LN_2 temperature and fully rotated (360°) during ion milling.

Image courtesy of K. Hono and D.H. Ping, NIMS (Japan)

Easy programming

Programming is extremely easy via a keypad mounted on the front panel. A mode key used in conjunction with four arrow keys allows the input of the various dimpling parameters. Prompts help guide the user through quick and easy programming steps. A liquid crystal display continuously shows performance information.

Zeroing is initiated by pressing the Zero key. A zero position can be established on either the surface of the platen or the surface of the specimen. This facilitates the ability to either dimple to a given thickness, or to remove a specific amount of material from the specimen.

Process termination

Final specimen thickness is readily programmed for accurate, unattended operation. However, at any time, the process can be either paused for specimen inspection or stopped. During grinding, specimen thickness is continuously displayed.

The Model 200 also features a time-based polishing mode. At the conclusion of an elapsed set time, the process automatically terminates.

Transmitted or reflected illumination

The platen that holds the specimen has a glass center section that allows light to be transmitted through the specimen from a source located beneath the specimen stage. The intensity level of the transmitted light is adjustable for optimal specimen observation. This is particularly important when dimpling silicon, which undergoes changes in color as the specimen approaches electron transparency.

The Model 200 also features illumination with reflected light from a high intensity lamp, powered by the Model 200's power supply.

Microscope for direct observation

A 40X microscope attachment allows direct observation without the need to remove the specimen.

Model 200 specifications

Grinding control	Automated grinding rate control
	Grinding force adjustable with micrometer counterweight system
	Independent control of grinding wheel and specimen rotation speeds
Specimen stage	Precise specimen stage rotation
	Magnetic mount allows easy specimen positioning
User interface	All program inputs via front panel keypad
	Specimen thickness indicated on a liquid crystal display
Specimen illumination	Specimen observation in either transmitted or reflected light
Enclosure	Weight: 18 lb (8.2kg)
	Size: 8.2" (208mm) W x 6.5" (165mm) H x 13.5" (343mm) D
Power requirements	110/220 VAC, 50/60 Hz, 375 watts
Warranty	One year

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Cover image: Optical image of a dimple ground XTEM specimen consisting of 19 individual sections of a microelectronic material. The image was taken using transmitted light and shows a color contrast due to the decreasing thickness of silicon as the center of the specimen is approached.

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