Dimple Grinder
Model 656

Rapid material removal with minimal damage. Dimple grinding offers a fast and reliable mechanical method of pre-thinning to near electron transparency (in some cases to electron transparency) greatly reducing ion milling times and uneven thinning.

Fast TEM Specimen Preparation: While mechanical grinding techniques are the fastest method for reducing material thickness during specimen preparation, they can introduce unacceptable damage and are not generally practical for final thinning. However, chemical and particularly ion or fast atom methods, while producing relatively little damage, thin slowly and unevenly, resulting in localized penetration and only small thin areas. The Gatan Model 656 Dimple Grinder will reduce, with minimal damage, the central region of a typical 100 μm thick, 3 mm diameter specimen blank to a few microns in times ranging from 20 minutes for silicon to 100 minutes for sapphire. Subsequent chemical or particle beam thinning is then completed rapidly to produce large electron transparent areas.

Prior to grinding, specimens are attached to a mount using a low melting point thermoplastic polymer (supplied by Gatan). The mount supplied also fits the Gatan Model 601 TPC-Tool Ultrasonic Cutter and the Gatan Model 623 Disc Grinder so that cutting the blank disc from the wafer; grinding it to about 80 μm thickness and dimpling it to below 10 μm can all be accomplished without demounting the specimen.

Large Transparent Areas: A further advantage of dimpling is that the specimen surface is exceptionally smooth and polished. This reduces the probability of surface irregularities developing in the brief final thinning operation and increases the yield of electron transparent material.

Stronger Specimens: The technique of dimpling produces a thin central region in the disc while leaving a thick, supporting rim, which protects the specimen from damage. For particularly fragile specimens a small 10 mm diameter grinding wheel leaves a wider rim than the standard 15 mm diameter wheels and provides even better specimen support.

Direct Preparation of TEM Specimens: The Gatan Dimple Grinder is precise enough to produce final thicknesses <3 μm. This is sufficiently thin for examination in intermediate voltage TEMs. Only materials resistant to mechanical damage, such as silicon, ceramics or hard metals are suitable for such preparation. To produce specimens of high quality, the grinding speed should be reduced to minimize damage and the final few microns must be removed with a special polishing wheel.

Accurate Depth and Thickness Control: The Gatan Dimple Grinder is equipped with a dual measuring system – a digital, electronic micrometer sets end stop and an analog dial indicator gives a continuous display of the dimple depth. Both indicators have a readout accuracy of 1 micron. The system enables accurate dimpling to be performed without prior knowledge of the specimen thickness. First, the grinding wheel is lowered gently onto the specimen disc using the cam control at the base of the dimpler. When the grinding load is fully transferred to the specimen, the dial indicator reads the depth of material which is to be removed to achieve the desired dimple depth. Grinding will continue and the grinding wheel platform will slowly fall until the dial indicator stylus reaches its zero stop, completing an electrical circuit which automatically switches off both the grinding wheel and the specimen rotation motors.

Micro-Positioning: The Gatan Dimple Grinder works on the principle of a flat horizontal specimen rotating about a vertical axis and a grinding wheel rotating about a horizontal axis. The best results are only obtained when the two axes are orthogonal and intersect. The Model 656 contains a simple, rugged alignment mechanism which achieves this condition to better than +/-10 μm. With this degree of lateral positioning accuracy, it is possible to locate the center of a dimple at a specific microscopic feature in a specimen. An x/y specimen stage and a pre-aligned microscope with center mark are provided for this purpose.

Improved Auger Profiling: A large 20 mm diameter grinding wheel is available for making shallow dimples and exposing near surface concentration gradients or producing accurate taper sections through surface coatings. Auger or other surface analysis techniques can then produce compositional depth profiles without the need for time consuming removal of material from the specimen surface while inside the analytical equipment.

Specimen Mounting Hot Plate: It is most important that specimens are firmly attached during dimpling. This is best done by using a low melting point wax polymer, supplied by Gatan, to form a strong, thin, hard adhesive bond. The Gatan Specimen Mounting Hot Plate is thermostatically controlled at the precise mounting temperature of 130°C. The hot plate also contains recesses to hold the specimen mounts in place when binding the discs.
### 656 Dimple Grinder

**Specifications**

<table>
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<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td><strong>Size</strong></td>
<td>300mmW x 200mmD x 125mmH (12”W x 8”D x 5”H)</td>
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<tr>
<td><strong>Shipping weight</strong></td>
<td>10kg (22lbs)</td>
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<tr>
<td><strong>Power requirements</strong></td>
<td>Universal voltage 100VAC - 240VAC, 50/60Hz</td>
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<tr>
<td><strong>Controls</strong></td>
<td>Table rotation (I / 0); grinding wheel rotation (I / 0); transmitted light (I / 0); grinding wheel speed (variable); AutoTerminator (I / 0); Micrometer zero; Grinding wheel load (0 - 40gms)</td>
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</tbody>
</table>

**Note:** Specifications are subject to change.

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**Ordering information**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>656</td>
<td>Dimple Grinder</td>
</tr>
<tr>
<td>623.40001</td>
<td>Specimen Mounting Hot Plate (100V)</td>
</tr>
<tr>
<td>623.40002</td>
<td>Specimen Mounting Hot Plate (240V)</td>
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Please consult with your sales representative for details regarding spares and consumables.

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**Please contact Gatan for information on our complete line of TEM specimen preparation instruments, including:**

- **Precision Ion Polishing System (PIPS™):** A user-friendly precision ion polisher designed to produce high quality, TEM specimens with minimal effort.
- **Liquid Nitrogen (LN2) Cold Stage, PIPS™ Sample Cooling Option:** To enhance the performance and capabilities of the PIPS™, a liquid nitrogen (LN2) cooling option is now available.
- **Low Energy Option:** PIPS™ upgrade kit allowing operation at low energy, down to 100eV.
- **Center Frontier:** The Center Frontier is an all-inclusive polishing system, complete with an automated, computer controlled, in-situ microscope and patented image processing system (SEM/ TEM/STEM/SIMS/SCA/PEM).
- **ModFish®:** Quality samples are produced in a controlled environment with reproducible results. The ModFish tool offers a non-selective, universal etching technique for structures made of dissimilar materials and composites.
- **High Resolution Ion Beam Cooling System (IBC):** The high-resolution ion beam based sputter coating system produces thin, amorphous, and oxide-free coatings in a controlled environment.
- **Precision Ion Beam Etching and Coating System (PECS™):** Tool solution used to reveal and enhance fine structural detail through ion beam etching and coating for analysis in the Light Microscope (LM), Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM).
- **Solarus®:** A new generation plasma system with unique H2/O2 gas chemistry, interactive touch screen operation, 2 front loading TEM holder ports and multiple SEM/TEM samples at top loading chamber.
- **Disc Punch:** Rapidly cut TEM discs from ductile and soft materials, while maintaining specimen quality. The precise construction of every unit guarantees sharp edges and easy disc ejection even after long term use.
- **Dimple Grinder:** Produces an exceptionally smooth thin area only a few microns in thickness, while minimizing distortion. Precision positioning and accurate electronic thickness control provide a wide thin area every time.
- **Ultrasonic Cutter:** Quickly cut simple holes, unique shapes or TEM discs from hard or brittle material ranging in size from <1mm to 10mm and in thickness from <0.4μm to 5mm.