

Dimple Grinder II

Model 657

The Dimple Grinder II provides 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 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 min for silicon to 100 min 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. The mount supplied also fits the TPC-tool ultrasonic cutter system, model 601, and the disc grinder system, model 623, 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.

A monocular microscope is provided for alignment and examination of samples. The reflection illuminator turns on automatically when the microscope is placed on the dimple grinder, and is turned off when the transmission illuminator is turned on. A slurry cup (reservoir) is provided to allow the use of pre-mixed polishing slurries, in combination with a timer for extended polishing steps.

Benefits

- **Large transparent areas:** Utilizes both the large wheel and flat wheel to preserve a large transparent area after processing
- **Stronger specimens:** Leaves a thick supporting rim to protect and strengthen the specimen after dimpling
- **Direct preparation of TEM specimens:** Produces a final thickness of $<3 \mu\text{m}$ in dimpled specimens
- **Accurate depth and thickness control:** User-defined stop point and real-time display ensure you can produce the appropriate dimple depth and thickness
- **Micro-positioning:** Provides both orthogonal and intersect axes for more accurate positioning



Applications

- Material science
- Natural resources
- Electronics

Large transparent areas: Both the large wheel (for bulk specimens) and flat wheel (for tough specimens, particularly metals), available with the dimple grinder, preserve a large transparent area after processing. However, the total wheels available with the dimple grinder is varied in both shape and edge. The small wheel preserves a wide, thick rim around the thin area for fragile specimens and produces steep profiles for analysis. The spherical edges wheel permits more accurate positioning of dimples and produces a spherical profile with a smaller thin area. This wheel is more suited to fragile or brittle specimens, such as ceramics and semiconductors.

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.

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Direct preparation of TEM specimens: The dimple grinder is precise enough to produce final thicknesses <math><3\ \mu\text{m}</math>. 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 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 $1\ \mu\text{m}$. The system enables accurate dimpling to be performed without prior knowledge of the specimen thickness. First, the grinding wheel is lowered until the dial indicator shows that it just touches the specimen mount and the digital micrometer is zeroed electronically. The micrometer can then be adjusted upwards to set the desired final thickness.

Second, 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 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 dimple grinder contains a simple, rugged alignment mechanism which achieves this condition to better than $\pm 10\ \mu\text{m}$. 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 prealigned microscope with center mark are provided for this purpose.

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. A customer supplied hot plate should be used with the sample mount at $130\ ^\circ\text{C}$.

Specifications

Size (W x D x H) (mm) (in.)	340 x 260 x 230 13 x 10 x 5
Shipping weight (kg) (lb.)	15 34
Power requirements	100 – 240 VAC, 50/60 Hz
Controls	Table rotation (I/O); grinding wheel rotation (I/O); transmitted/reflected light; grinding wheel speed (variable); AutoTerminator (I/O); timer (variable); micrometer zero; grinding wheel load (0 – 40 g)

Specifications are subject to change.

Ordering

Model	Description
657.B	Dimple Grinder II

Other products to consider

- PIPS™ II
- PECS™ II
- Solarus® II Plasma Cleaner
- Disc Punch
- Disc Grinder
- Ultrasonic Cutter

