Dimple Grinder

These instructions are intended for reference only, and will *not* replace the thorough training required for proper system operation. Contact a clean room staff member with questions or to report a system problem.

Written by Dr. Amir Zangiabadi
1. Enable the tool in BADGER

2. Before using Dimple grinder:

   The sample thickness should be in the range of 100μm to 300μm. The thinning can be done by a polisher-grinder instrument.

   You need to **measure the thickness** of your sample by the micrometer screw gauge before using the dimple grinding.

3. Recognizing different parts of dimple grinder:

   1. Zero stop
   2. Raise/lower cam control
   3. Analog dial indicator
   4. Autoterminator socket
   5. Pivot platform
   6. Load scale
   7. Counterweight
   8. Microscope socket
   9. Wheel motor socket
   10. Main power On/Off switch
   11. Power On indicator
   12. Speed control (wheel)
   13. Autoterminator control
   14. Dimple depth zero
   15. Dimple wheel axle
   16. Microscope mount
   17. Magnetic turntable
   18. Dimple wheel
   19. Micrometer drive
4. From the drawer under the dimple grinder instrument pick the **glass mount**.  

The sample will be fixed on the top flat surface of this glass with the **wax**.

<table>
<thead>
<tr>
<th><img src="image1.png" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>A hand holding a glass mount.</td>
</tr>
</tbody>
</table>

5. Turn on the hotplate that is on the table by rotating the knob to numbers 2 or 3, then place the glass mount on it and wait 5 minute for the heater and place the glass mount on the plate to heat up.

From the same drawer pick the wax and use a very small amount of wax to attach the sample on the glass mount.

The glass top should be hot enough to melt the wax and spread on the top surface.

Gently press the sample (that was grounded to a few hundreds of micrometer in thickness by Grinder-Polisher) against the wax and make sure the sample is not being submerged in the wax. It is important to not use too much wax. Use the tweezers to push the sample and make sure it is flat and very close to the center of the glass top.

<table>
<thead>
<tr>
<th><img src="image2.png" alt="Image" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>A hand holding a small tube of wax and a hotplate.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Pick up the glass mount and place it on a cool surface (e.g. right side of the hotplate) to gradually cool it down.</strong></td>
</tr>
<tr>
<td><strong>6. As shown, place the glass mount inside the metal piece holding the glass mount (magnetic turntable, number 17 in the instrument schematic) and place the stereoscope over the microscope mount to observe the specimen (in next image).</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>7.</td>
</tr>
</tbody>
</table>
9. Adjusting sample height (thickness):

Lower the Pivot Platform (#5 in schematic) and rotate the Cam Control knob (#2) on the far left toward yourself to fully engage the grinding wheel with the sample.

At this point we want to make sure that the analog micrometer is also engaged (the dial quickly moves by lowering the platform).

If the dial doesn’t move at all, it means the sample is a bit taller and prevents the micrometer
from getting engaged and the micrometer needs adjustment.

Rotate the Micrometer Drive (black wheel on the bottom, #19) counter-clock-wise till you see the micrometer dial is moving. Then adjust it to zero (as shown).

During the grinding, sample loses its thickness and this lowers the platform and makes the dial turn clock-wise. The number shown by the dial is the amount of the material/thickness that is removed.

When the dial is on Zero, press Zero button on the right to reset the digital dimple depth indicator.

10. Applying grinding solution:

The grinding wheel is made of a soft material and we need a hard medium to do the grinding. **Diamond paste** is used for the purpose.

Diamond paste comes in different particle sizes. We normally start with coarse particle size (15 micron) and continue to 1 micron and do the final polishing with 0.5 micron solution.
Apply a tiny amount of diamond paste on a wooden stick and dissolve it in a few drops of water.

11. Apply this diamond solution to the sample surface and the grinding wheel edges.

When changing the diamond paste size, make sure the previous diamond paste is removed by cleaning it with a tissue paper and water.
12. Lower the Pivot Platform and the Cam Control knob to fully engage the grinding wheel and the micrometer.

Press the **Arm** button to start rotating the grinding wheel, then press **Table** button to rotate the sample.

This process creates a spherical dimple that is thinner in the middle. This process is shown on the following schematic.

13. Continue grinding till the sample thickness reaches 20μm (or lower depending on your material).

Change the grinding wheel to a **polishing wheel**.

Make sure you dry and clean the sample surface and the grinding wheel with water.

Use a small drop of **0.5 Micron diamond solution** on the sample surface and continue polishing for 5-10 minutes.
14. There are two options to do the final step of TEM sample preparation:

1- Use **PIPS instrument** to further thin the sample till it gets transparent (refer to PIPS manual or ask staff). *Nicer surface!*

2- Continue polishing with dimple grinder, till you see light is going through the sample from the middle part. *Rough surface!*

15. When you are done, clean the wheels under running water, submerge them in the isopropanol and **sonicate** them for few minutes, **twice**! After they get dried, place them in their box.

16. Make sure the table and the machine are clean and organized.

17. **BADGER LOGOUT:** Don’t forget to disable the tool in badger after you’re done.