Tripod Polisher™ Tip #1
Fast Grinding to Optical Transparency on the Second Side

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With the new "L" brackets that are available for the Tripod Polisher™ (South Bay Technology, Inc.) which allow the sample to be easily backlit with room lights, it is relatively easy to grind away most of the material to be removed when polishing the second side of a sample. The following steps outline the procedure that I have been using for rapidly removing material and getting the samples very thin prior to starting the final wedge polishing. The samples that I have been preparing with this technique are approximately 1 μm thick, pulsed laser deposited ZnO-WS_2 films on SiC substrates.

1) A piece of microscope slide is cut to approximately 4 x 4 mm to mount my samples on. After sticking the sample on the glass slide with superglue, the glass slide is mounted onto the Pyrex stub with the low temperature wax. If the low temperature wax is used to mount the sample onto the glass slide, then the glass slide is placed on the stub first and then the sample. The sample will be mounted as close to the edge of the glass slide and as close to the flat on the Pyrex stub as possible.

2) After the Pyrex stub is inserted into the Tripod Polisher™, the height from the surface of the glass slide to the bottom of the "L" bracket is measured and the micrometers are retracted below the "L" bracket. Hold a flat plate like a lantern slide tightly to the bottom of the "L" bracket and adjust the rear micrometers until they just touch. Then turn the micrometers out the same distance that was measured to the surface of the glass slide. The feet and surface of the glass slide are now fairly coplanar.

3) Decrease the height of the rear micrometers by six turns (3 mm). This puts a reverse wedge angle on the Tripod Polisher™, i.e., the back of the sample will be thinner than the front during polishing. Of course, 3 mm could be subtracted from the original measurement and adjustment in step #2, but to visualize the angles involved, it is best to do the turns at first.

4) Grind the sample using the coarse grit film with the rear micrometers leading the sample. Do this by holding the Tripod Polisher™ in the normal manner, but using the opposite side of the wheel. (If there is a lot of material to be removed and the material is hard such as SiC, hold the feet off the film a little until the sample is reasonably thin before letting the feet wear on the film.) Watch the progress of polishing until the glass slide starts to be ground on its back edge.

5) Adjust the micrometer until the ridge made by polished and unpolished portions of the glass slide is parallel to the front edge of the sample. In the case of an XTEM sample, this will also be parallel to the interface of interest. This roughly aligns the micrometers relative to each other so that the leading edge of the final wedge will be uniform across the front of the sample. When making adjustments, note the wear face on the feet and turn them back to where they were prior to the adjustment. Continue grinding until the polished area of the glass slide is within 0.5 - 1 mm from the back edge of the sample. The closer you are to the back edge, the thinner the sample will be at that edge. If you get too close at such a large angle, the sample will be ripped off. Some trial and error will be needed here and the distance will also depend on the thickness of your substrate. If you are bold, go as close as you dare. You can measure the thickness of the back edge of the sample with a calibrated fine focus dial on your optical microscope if the excess glue around the sample doesn't extend too far from the sample.

6) Return the feet the six turns to make them coplanar with the surface of the glass slide again. Grind the sample until the new polishing ridge on the sample meets the back side of the substrate. You might want to decease the film grit size just before the back edge is reached. The sample surface should be roughly parallel to the first polished side of the sample. To be more cautious, return the feet five turns, grind to the back edge, and then "ratchet" the angle forward with incremental adjustments and subsequent grinding to the back edge. The ridge will be harder to see when finer adjustments are made. If this is done with 6 μm grit or less, the ridge produced can be followed more easily by using a glass lantern slide placed over the sample and feet and viewing the optical fringes produced by the air gap when viewed in the reflected light from the room lights.[1] Use an 8-10x loupe turned around to see the fringes more clearly. The fringes are most easily seen by tilting the loupe and your head until you can see the glare off of the sample from the lights.

7) Continue polishing until the sample starts to get optically transparent when viewed with an 8-10x loupe (using the loupe correctly) and backlit with the room lights. Adjust the micrometers if the transparent region is not uniformly transparent. Depending on the translucence of the sample, start producing the forward (normal) wedge angle with either 15, 6, or 3 μm grit size. Some trial and error will be needed.

8) Proceed normally. You should be within 10-15 divisions on the micrometers of producing a good wedge. I don't turn the Tripod Polisher™ around and polish normally (i.e., feeding the leading edge of the sample into the film) until I am on the 1 μm film and have optical fringes appearing and the wedge angle is low enough. To gauge that, there should be a lot of fringes with wide spacings between them when viewed with the inverted microscope.

9) An aluminum block was made with a slot cut into it sufficiently wide to hold the glass slide in the Petri dish filled with acetone so that the sample can fall onto the filter paper. This also has the advantage of freeing the "L" bracket for further use.

1 J.B. Liu, B.M. Tracy, R. Gronsky, *Microscopy Research and Technique*, 26, p.162, '93.