

# Ultrasonic Cutter

The proven and most effective method for rapidly cutting brittle materials is mechanically coupling a piezo crystal cutting tool vibrating in fine grain boron carbide slurry.

The Tuned piezo cutting (TPC) tool employs a lead zirconate/titanate piezoelectric crystal to vibrate a tubular cutting tool at a frequency of approx 26kh against a specimen. A slurry of water and boron nitride is applied around the tip of the tool.

The high frequency vibrations cause particles in the slurry to impact the specimen, eroding away a circular impression, eventually “cutting” a section from the specimen.

Operating procedure:

1. First mount your samples on the glass slab (upside down) rough surface from above and your sample shining surface on downside.
2. Place your samples on metal slab and then on magnetic base present on the tool.
3. Then take your preference of cutter rectangular or cylindrical.
4. Rectangular cutter is for cutting 4mmX6mm of rectangular pieces and cylindrical is for cutting your cylinder (2.3mmdia) from a stack made of 4mm.
5. So suppose you want to cut samples through ultrasonic cutter first take copper washer see to that its not broken and take your preference of cutter (rectangular or cylindrical).
6. Then first place washer then cutting tool on the threads provided on the tool.
7. First tighten it with your hand then take a cutting tool wrench with the center hexagonal hole to tighten the cutting tool and rotate it around 15 degrees.
8. Switch on the power.
9. Then using cutter height control knob takes it down to your specimen for cutting the sample (measure sample thickness before using micrometer screw gauge).
10. Apply the cutting grid and make the slurry on your region of interest on your sample using manual tuning knob set the frequency and cutter will start cutting your specimen.
11. If suppose your sample thickness is around 600micron there is a depth of cut dial indicator present on the tool which will show you how much depth of cut has been done on your sample.
12. Raise the cutting tool when the desired depth of cut is achieved.
13. Repeat the cutting process in a new location if needed.
14. When all cuts have been made, switch off the power and remove the specimen table.
15. Wash of the slurry and remove the cut sample of the specimen.

#### Mounting a Specimen:

1. Place the specimen table on the hot plate (130 degree C).
2. After 5 minutes, apply some wax to the specimen table.
3. Place the glass slide onto the pool of molten wax.
4. Apply a small amount of wax to the center of the top of the glass slide.
5. Place the specimen on the small pool of molten wax on the glass slide.
6. Gently press the specimen down.
7. Remove the specimen table from the hot plate and allow it to cool.
8. When the specimen table has completely cooled, place it on the center of the notched magnetic base.

#### Cutting Specimen:

1. Position the specimen table on the magnetic base assembly and slide the assembly onto the base of the TPC tool.
2. Apply the cutting grit and make the slurry.
3. Lower the cutting tools into the slurry until the hinged platform is properly deflected switch on the power and follow the progress of the cut on the dial indicator.
4. Monitor the depth of cut using the horizontal reference indicator.
5. Adjust the cutting rate using the tuning knob.
6. Notice the change in sound made by the TPC tool, and set the tuning knob to the most effective frequency.
7. Raise the cutting tool when the large dial indicator needle just passes through the zero mark.
8. Repeat the cutting process in a new location if needed.
9. When all cuts have been made, switch off the power and remove the specimen table.
10. Wash of the slurry and remove the cut sample of the specimen.

#### Removing specimens:

1. Once a sample has been cut it can be removed from the specimen table.
2. Be sure the power is off.
3. Remove the specimen table from the magnetic base assembly.
4. Place the specimen table on the hot plate to melt the wax.
5. Slide the specimen cut to the edge of the glass slide and carefully pick it up with tweezers.
6. Wash the cut samples in acetone to remove the wax.
7. Remove the specimen table from hot plate and let it cool.
8. If necessary, remove the glass slide from the specimen table.

## **Disc cutter**

1. Slicing the specimen discs mount he metal reinforcing tube assembly on a support block using the low melting point wax.
2. The metal reinforcing tube containing the specimen cylinders may now be sliced into a series of 250 to 400micron meter thick discs using a thin diamond saw.
3. These discs may now be handled like any other TEM specimens and are ready for the standard pre-thinning operations such as disc grinding and dimpling.
4. Any wax adhering to the specimen discs can be removed using acetone.