

## Preparation of Rare Specimens for Isotopic Analysis

### Introduction:

For some projects the minerals in question could be rare, with only one or two being found from several thin sections. In this instance it may be preferable to re-mount the minerals into a single block together with an appropriate standard. Or, purely by chance, a thin section may contain many perfect examples for study but a standard needs to be mounted within the section to enable high precision analysis to be undertaken.

The Facility can provide an ultrasonic drill to remove the specimen without damage, or drill a hole in the thin section to embed a standard in the appropriate position.

### What is an Ultrasonic Drill:



An ultrasonic disk drill is a proven method for producing thin disc shaped specimens from hard, brittle materials such as ceramics, glasses, polished thin sections, and geological materials. This technique produces disks (ID of ~1-3 mm) or cylindrical rods from bulk samples, or cut small diameter holes in thin sections free from significant edge and surface damage.

The ultrasonic disc cutter uses the excitation of lead zirconate titanate (PZT) crystals oscillating at a frequency of 26kHz to produce a cutting action. The cutting medium is an abrasive slurry of either boron nitride, diamond or silicon carbide dripped onto the sample.

This document describes two uses of the ultrasonic drill:

- Insertion of a standard into a thin section.
- Multiple specimens mounted into an Indium block.

### Links:

#### **Gatan Ultrasonic Drill:**

[http://www.gatan.com/products/specimen\\_prep/products/601\\_UltrasonicCutter.php](http://www.gatan.com/products/specimen_prep/products/601_UltrasonicCutter.php)

#### **CrystalBond:**

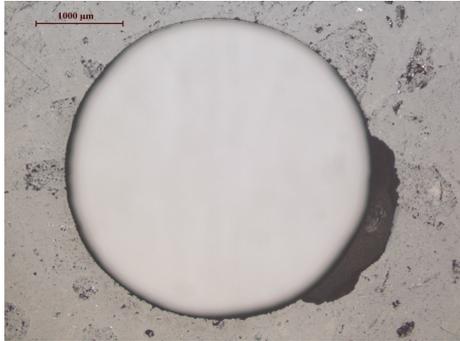
[http://www.agarscientific.com/catalogue/action\\_catalogue.asp?spx=1&sat=2&saa=11&jumpto=15CB](http://www.agarscientific.com/catalogue/action_catalogue.asp?spx=1&sat=2&saa=11&jumpto=15CB)

#### **Epo-Thin Epoxy Resin:**

[http://www.buehler.com/productinfo/consumables/pdfs/COLD\\_MOUNTING.pdf](http://www.buehler.com/productinfo/consumables/pdfs/COLD_MOUNTING.pdf)

## Insertion of a standard into a thin section.

**Step 1:** A small hole is drilled in the thin section close to the centre of the mount using the ultrasonic drill. The hole size can be 0.5 - 3mm in diameter.



Reflected light photo-micrograph of a standard polished thin section cored with a ~2.5mm hole. Minor damage to the section can be seen where the rock section has lifted from the glass substrate.

**Step 2:** A fragment of a standard is pre-prepared. The standard is mounted on a glass slide using wax, Crystalbond or Lakeside then flat ground and polished to obtain a polished surface. It is then removed from the glass slide and cleaned with Acetone.

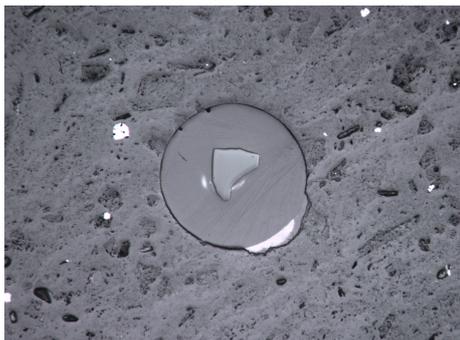
**Step 3:** Using brown parcel tape (3M Scotch), cover the surface of the thin section and from the back, place the pre-prepared sample into the drill hole, polished side down.



In this example a small fragment of BIR glass standard has been placed on to the brown tape. There has been slight fracturing of the back of the glass substrate.

**Step 4:** Back fill the drill hole with Epo-thin epoxy resin.

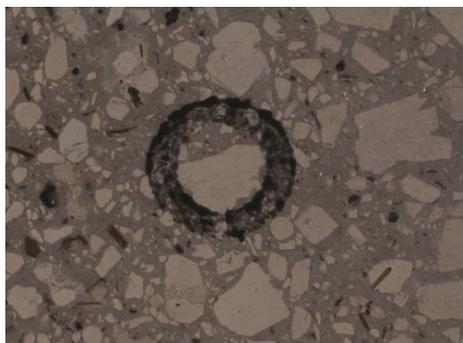
**Step 5:** After curing, remove the parcel tape and carefully grind and re-polish the thin section so that the sample and standard are flat and the surface polished. With pre-preparation the minimal amount of material needs to be removed, but be careful!



Reflected light photo-micrograph of the polished standard (BIR) and the surrounding thin section.

## Multiple specimens mounted into an Indium block

**Step 1:** The thin sections are examined under a reflected light microscope and the areas of interest are marked using a Nikon Objective marker.



The crystal to be removed has been marked using the Nikon marker. The internal diameter of the ink-ring is ~2mm and easily visible to accurately align the drill bit to the required position.

**Step 2:** Using the ink marks, each area of interest is cored using the ultrasonic drill.



Three samples extracted from three separate polished thin sections. Each core is ~2mm in diameter with the area of interest in the centre. In this example, the olivine crystals contain rare melt inclusions and are being prepared for  $\delta^{11}\text{B}$  isotopic analysis.

**Step 3:** The cored samples are washed in de-ionised water to remove the abrasive powder, allowed to dry and pressed into an Indium mount together with a standard, if required.



Reflected light photo-micrograph of four cored samples pressed into indium ready for gold coating and analysis.

**Step 4:** Final cleaning. Clean the sample in Acetone and then Ethanol. Do not use the ultrasonic bath as this can loosen the cores.