

## Single Crystal Mounting on Closed Cycle Systems

Alfred Baron, 2023 and before

Closed Cycle Cryostat CCC (<10 - 300K)  
Cryofurnace (~20 - 500 or ~20 - 750K – lower limit detail dependent)  
JT Cryostat (<2 - 300K)

The above sample environments are placed on an XYZ stage inside of the Eulerian (phi/chi) cradle that allows sample motion over +2mm in each direction (more in Z). The XYZ stage is used to align the sample in the x-ray beam.

Note that

1. The weight and tubing of the cryostat & XYZ stage can limit the range of sample motion.
2. When chi changes significantly, the sample position can shift requiring re-alignment.
3. These closed cycle systems all have ~10 um vibrations, especially in the Z direction (along the axis of the sample holder).

### Sample Mounting:

The sample holder must

- rigidly and stably support the sample
- provide thermal contact (sometimes replaced by He exchange gas - CCC only)
- not create background
- allow access to all desired reflections
- possibly, some Bragg cases, allow azimuthal rotation of the sample.

Often glue (epoxy) is used to attach the sample to the holder for  $T < \sim RT$ . Varnish can also be used for low T the sample has a large mostly flat surface. Silver paste is also a good option for low and high T. For high temperature, there are some ceramic cements (ceramabond) - but sometimes these are not stable. We do not always have all types of glue, so either bring what you want or check with staff.

Different types of holders are possible depending on the sample size, geometry or other details.

All these systems use an M4 threaded hole 30 mm from the nominal sample location. For the cryofurnace, the total hole depth is only 4 mm, so better to keep these threads  $< \sim 4$ mm long. Typically the holders are either copper or beryllium copper alloy.

Sketches of typical holders are on the next page. We can, if needed, send holders – but please also consider having them made locally - if you are outside Japan the cost of sending a holder can be more than the cost of making a holder.

In general, it is possible to mount ~0.3 mm scale samples – but it becomes increasingly difficult as the size becomes smaller. Also, while we are happy to make our microscope and other equipment available, we do not enjoy mounting samples, and prefer that the sample responsible do it.

