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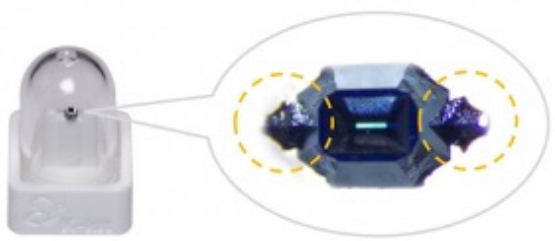
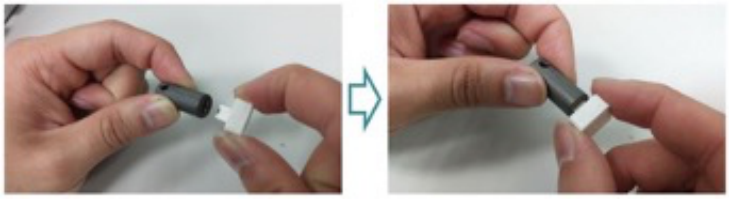
K-kit User Guide

1. Unpack the K-kit Carrier

First, leaving the clear cap in place to protect the K-kit, use a paper clip to push open the bottom compartment through the holes in the corners.

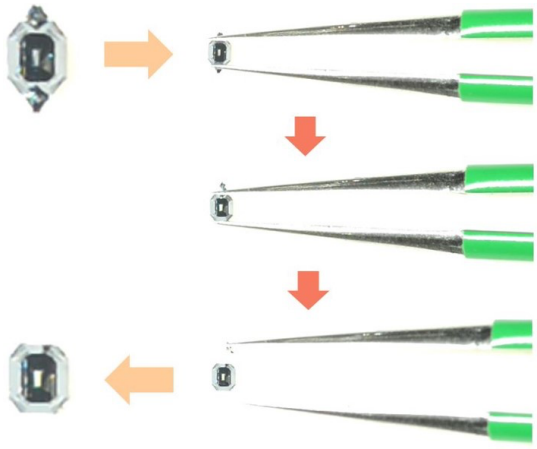




2. Remove the Channel Tips

There are channel tips at each end of the channel to protect the surface condition before use. Use the channel opener to open the channel by inserting the K-kit carrier top into the opener. Gently push into the end. The channel opener has a self-guiding slot and a mechanism to break off the tips before the carrier top plate reaches the end.

To take down the K-kit from its carrier and stick it on a glass slide, one can remove the channel tips by using a tweezer. Please refer to the procedures as described below. After the channel tips being removed, the K-kit should be put back to the carrier appropriately for the next liquid-loading step.



1. Prepare a glass slide with a small piece of double-sided tape pasted on it
2. Take down the K-kit from the carrier and stick it to the tape on the glass slide
3. Put the tweezer arms aligned at both necks of the channel tips
4. Gently press down the tweezer arms to break off the channel tips
5. Remove any debris and put the K-kit back to the carrier
6. The freshly opened K-kit is ready for the next step of liquid loading

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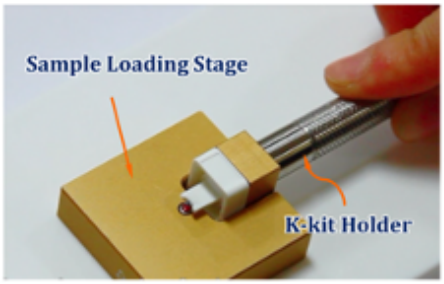
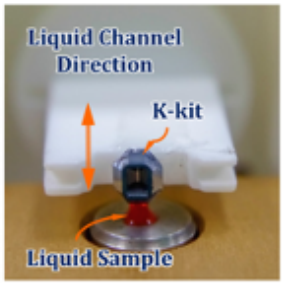




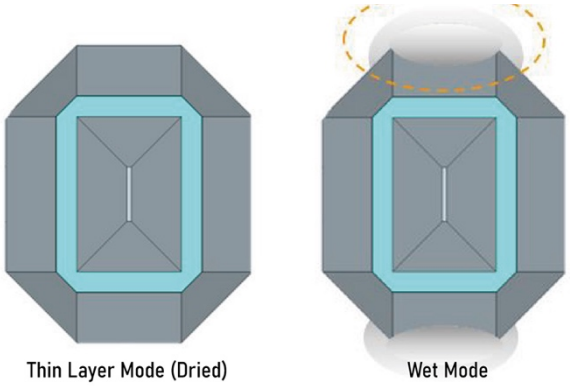
3. Liquid Loading

Place about 2 micro-liter liquid samples at the center of the Sample Loading Stage.

Place the K-kit carrier at the end of the K-kit holder.

Fit the notch of the holder onto the horizontal rod on the Loading Stage, forming a lever hinged on the rod. This will place the K-kit on the carrier right above the liquid drop. Lower the K-kit to make contact with liquid by gently lifting the back of the K-kit Holder.

Liquid fills the channel through capillary force. The liquid surface is “pulled up” by the K-kit. Keep the K-kit steady for approximately 1 min to allow for the filling to complete. The aqueous liquid sample should be placed on a glass slide. Both the K-kit and glass surface are hygroscopic. Do not immerse the K-kit in liquid.



4. Vacuum Seal

Place the K-kit carrier on the Gluing Stand. Use Needle Pen to pick and apply the Torr Seal epoxy onto the channel openings. Cover the channel openings at both ends with adequate amount of Torr Seal epoxy. To ensure the liquid can be well reserved in K-kit, it’s strongly recommended to complete the channel-sealed gluing within 1min after liquid loading.

If you would like to make a Thin Layer (Dried) mode of K-kit, it’s essential to keep both ends of the channel open to the atmosphere, no need to do this glue-sealed step.

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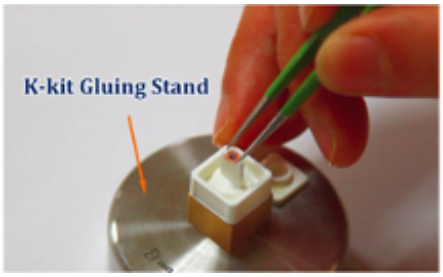
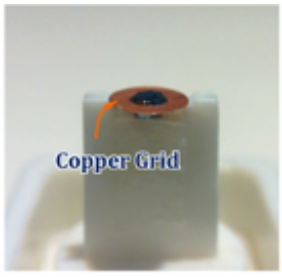
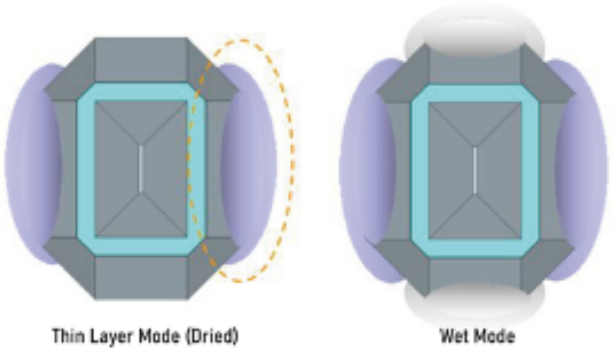


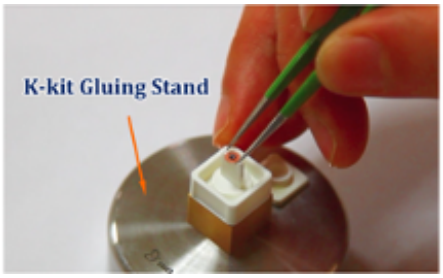


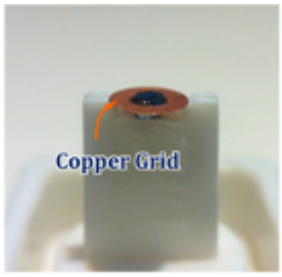


5. Copper Grid

Keep the K-kit carrier on the Gluing Stand. Use Needle Pen to pick and apply the Mounting Glue epoxy on to K-kit peripheral. Then, place the supplied copper grid over the K-kit. The steps on the carrier top plate facilitate centering and leveling the copper grid.

You should put the mounting glue on the long sides of K-kit body, keeping both ends of the channel without touching any glue at all, when making a Thin Layer mode of K-kit.





6. Copper Grid

Put the glued K-kit into an evacuating device. Vacuum pump the K-Kit for 30 minutes. Then, the specimen is ready for TEM observation.

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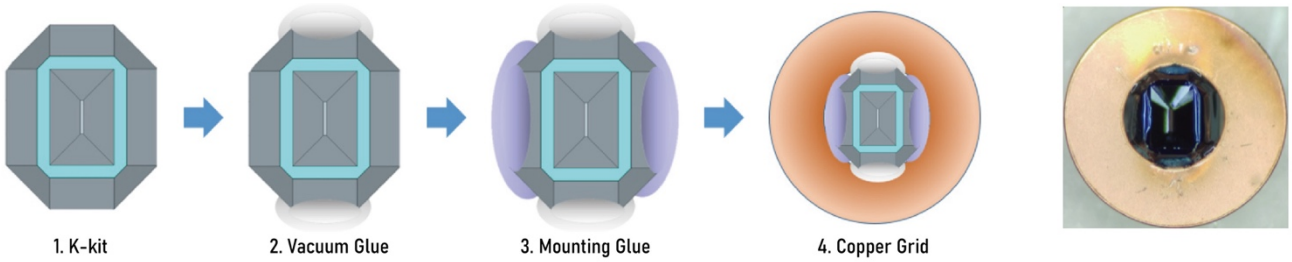
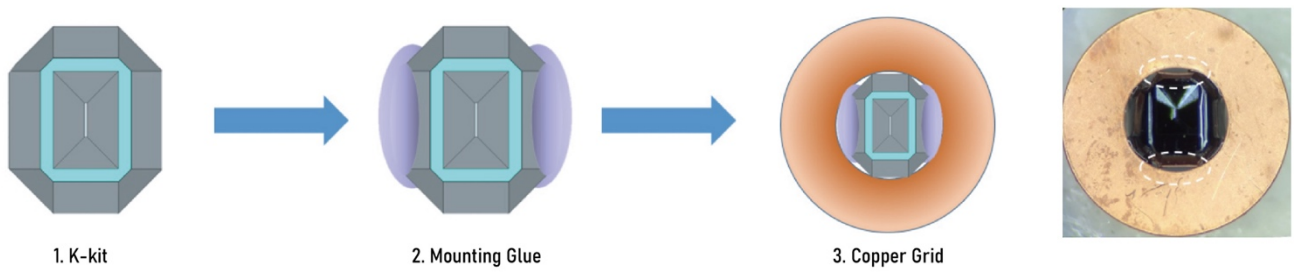
K-kit Gluing Procedure

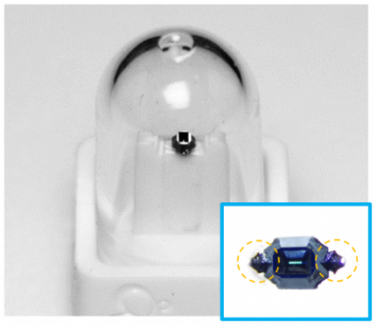
Wet Mode

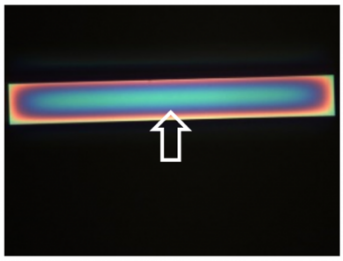


Thin Layer (Dry) Mode



Precautions

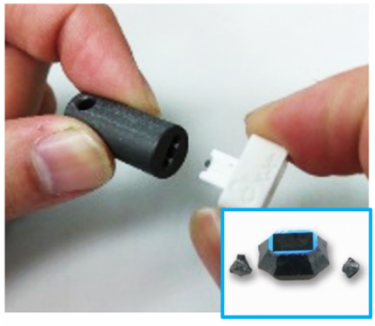


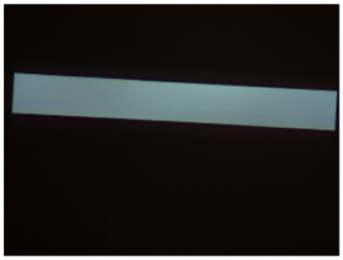


With Newton' s rings
(Sealed by channel tips)

Inspection before use

- With Newton's rings on the membrane (be sure the channel to keep vacuum sealed)
- Free of any damage on Silicon body of K-kit





Flat membrane
(Open to atmosphere)

Channel tips removal

- Be sure to remove both the channel tips before using K-kit
- The liquid loading should be finished within 0.5 hour after breaking the channel tips

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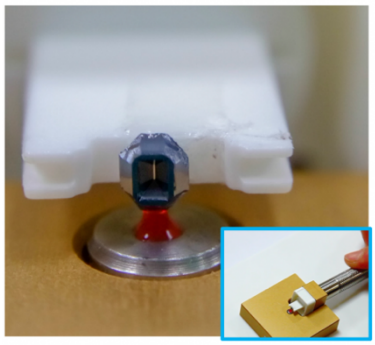
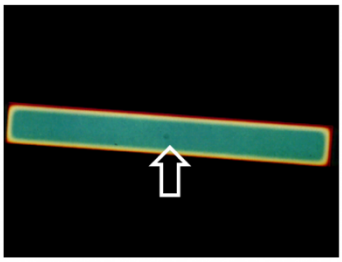
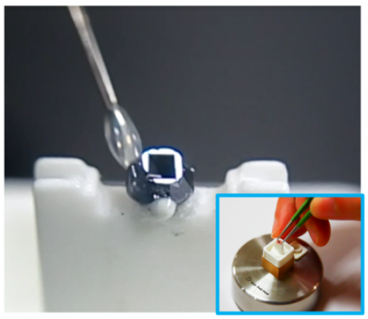


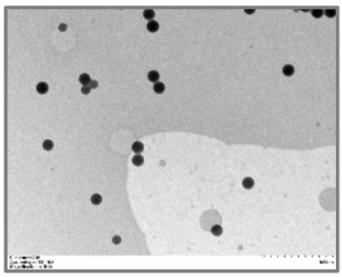


With color patterns
(After liquid filled)

Liquid loading

- Keep the K-kit steadily touching liquid for around 1 minute, allowing the filling to complete
- Do not immerse the K-kit in liquid





Liquid well reserved
(Soon to glue the openings)

Gluing process

- Glue both ends of the channel within 1 minute of liquid being loaded
- Be sure not to do channel gluing step if making for Thin Layer mode
- Undertake gluing step with care, to avoid glue flowing into the observation window

Two packages for shipping

Four pack

Six pack

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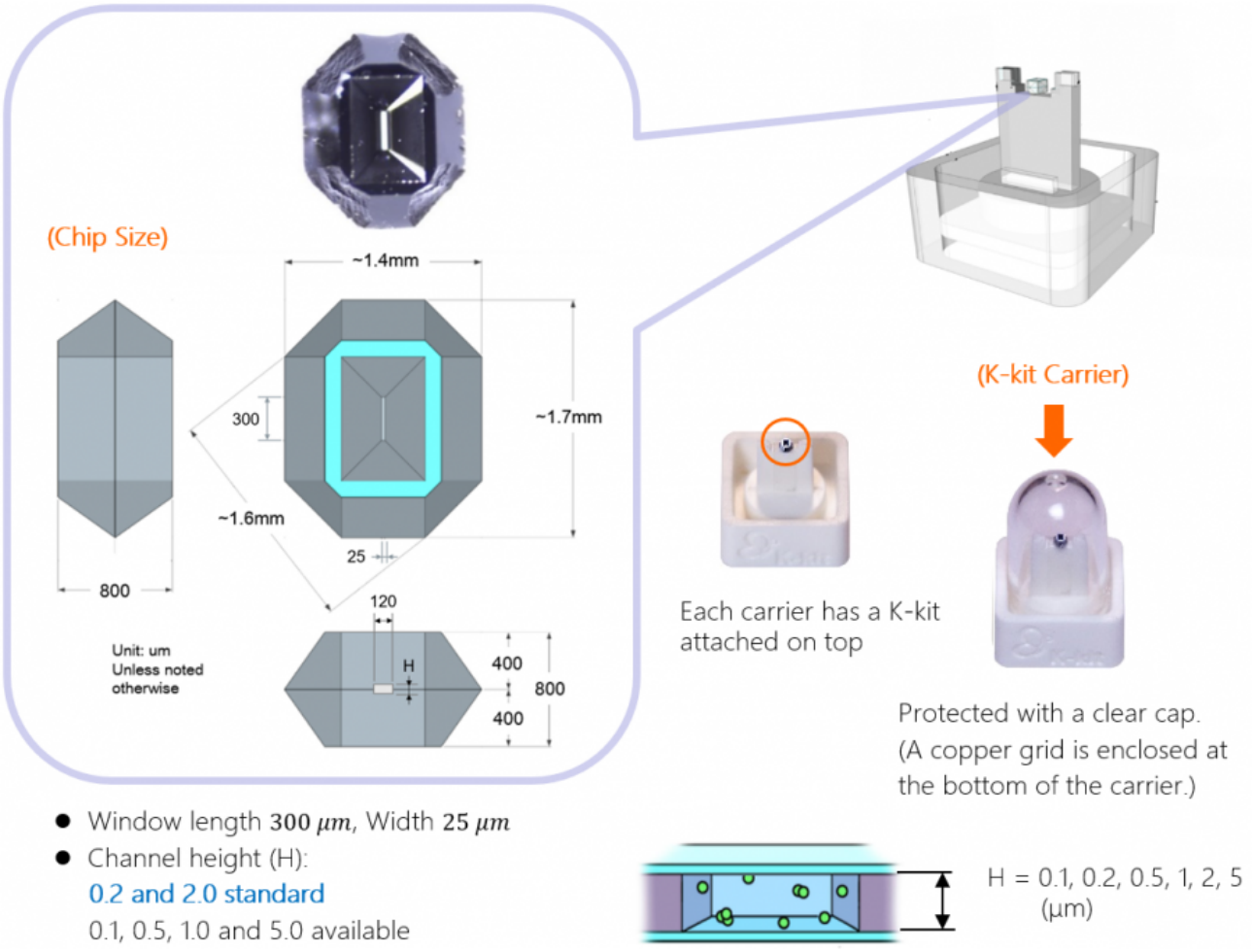
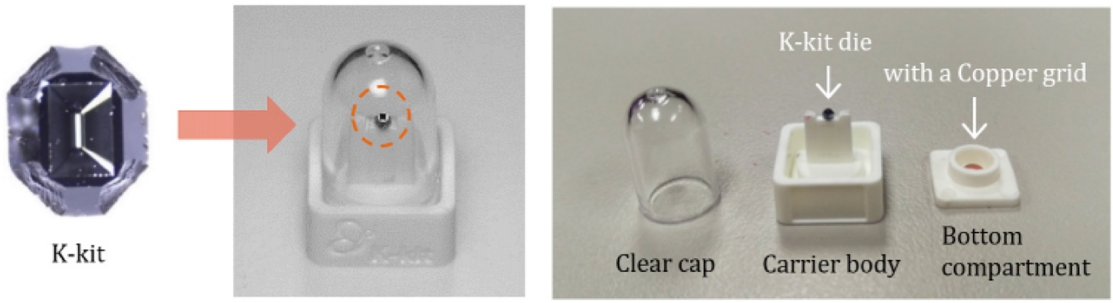
K-kit Carrier



- Window length 300 μm, Width 25 μm
- Channel height (H):
  0.2 and 2.0 standard
  0.1, 0.5, 1.0 and 5.0 available

The carrier is designed as a protective container during storage and shipment. It also serves as sample preparation facilitator, incorporating the hand tools available from us (see below). Thus, the K-kit stays on the carrier plate for the entire sample preparation protocol until after the copper grid is attached.



K-kit packaging includes a clear cap, a carrier with K-kit sitting on top of the plate and a bottom compartment housing a copper grid.

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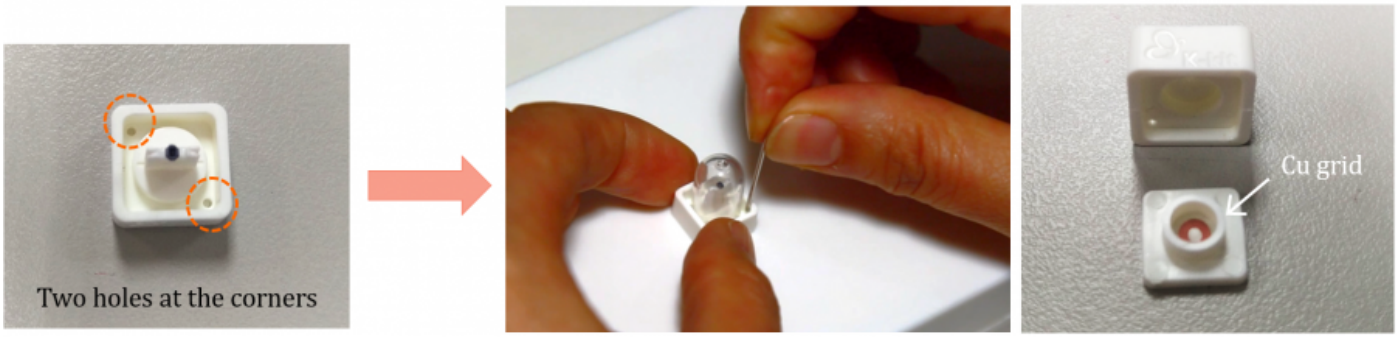
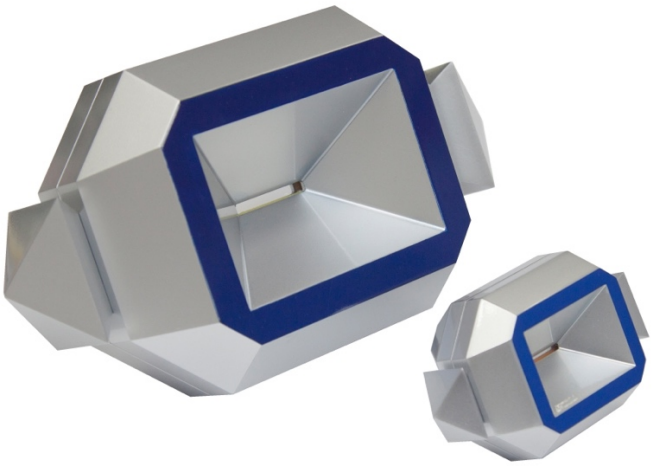


Leaving the clear cap in place to protect the K-kit, use a paper clip to push open the bottom compartment through the holes at the corners.

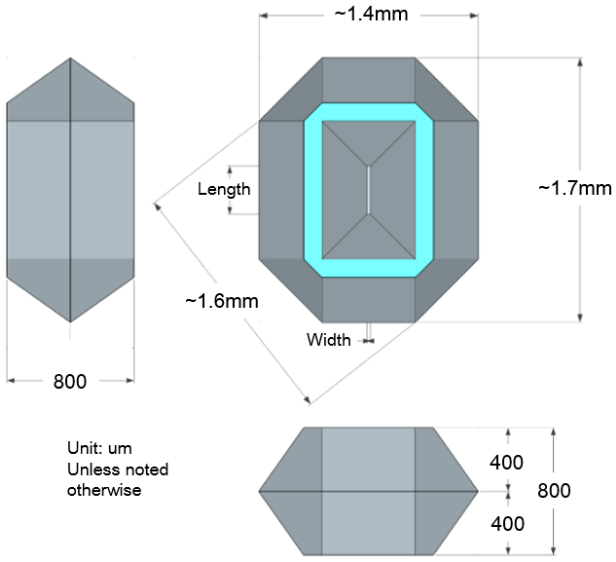
Scaled-up Models

Scaled-up models (100X, 50X) of K-kit made of acrylic are available. The shapes are to scale except for exaggerated channel height for clarity.

K-kit dimensions (nominal values given, for reference only)



Scaled-up 100X and 50X of K-kit models



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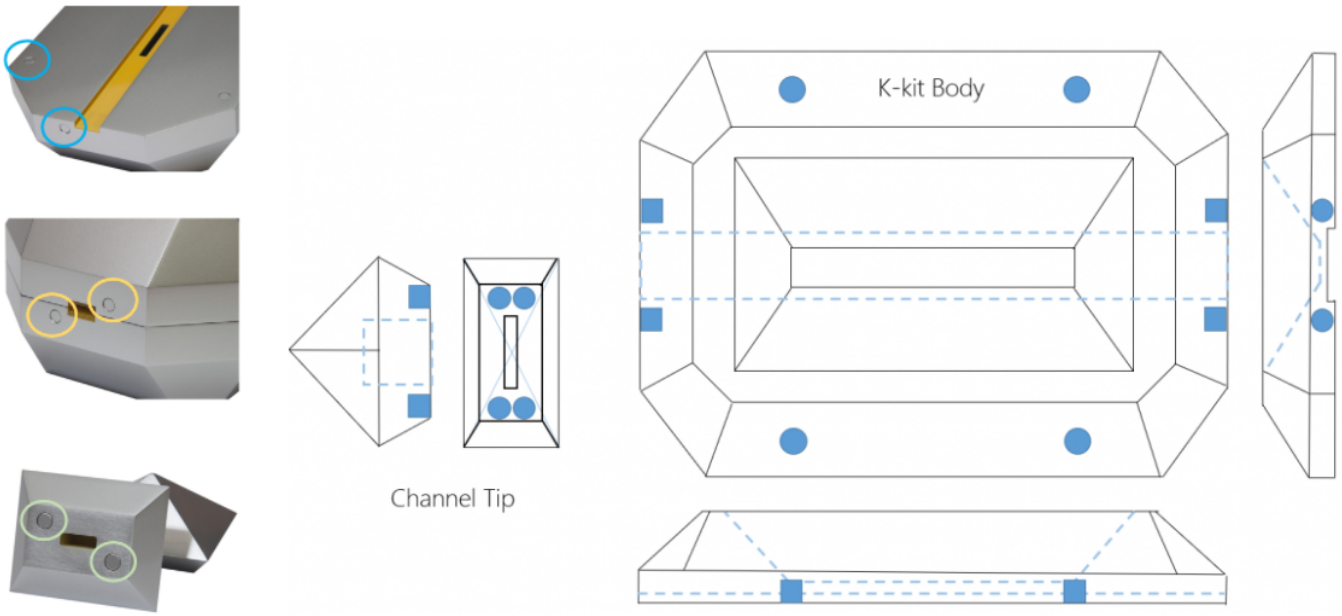
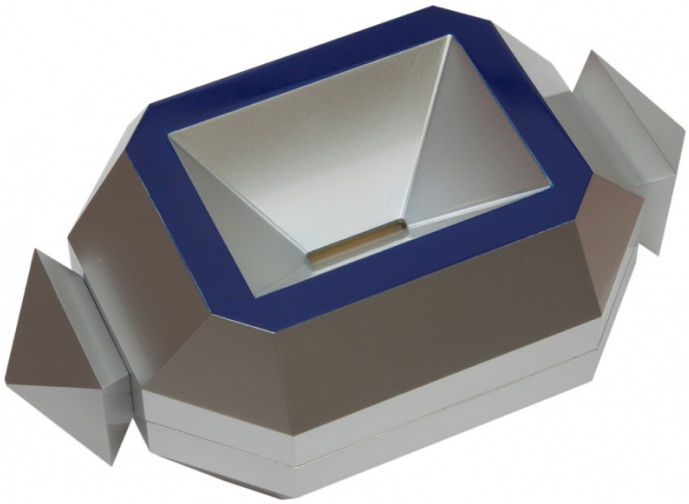
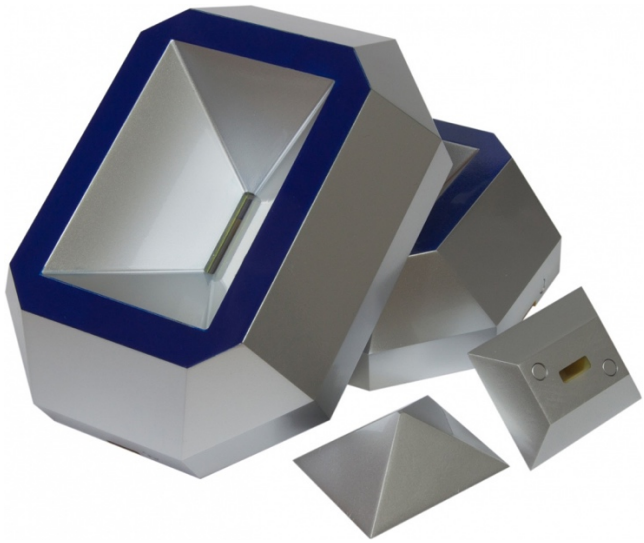


Model parts joint by magnets (Note: Blue dots denote magnets)

The Acrylic model





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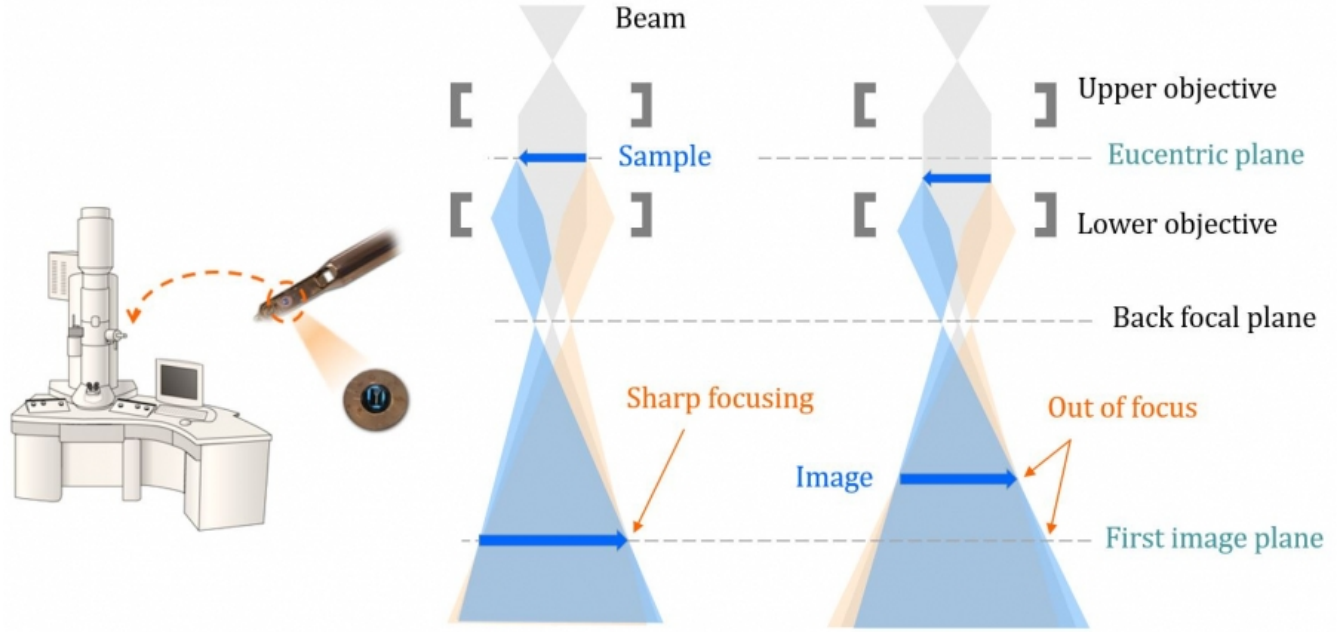
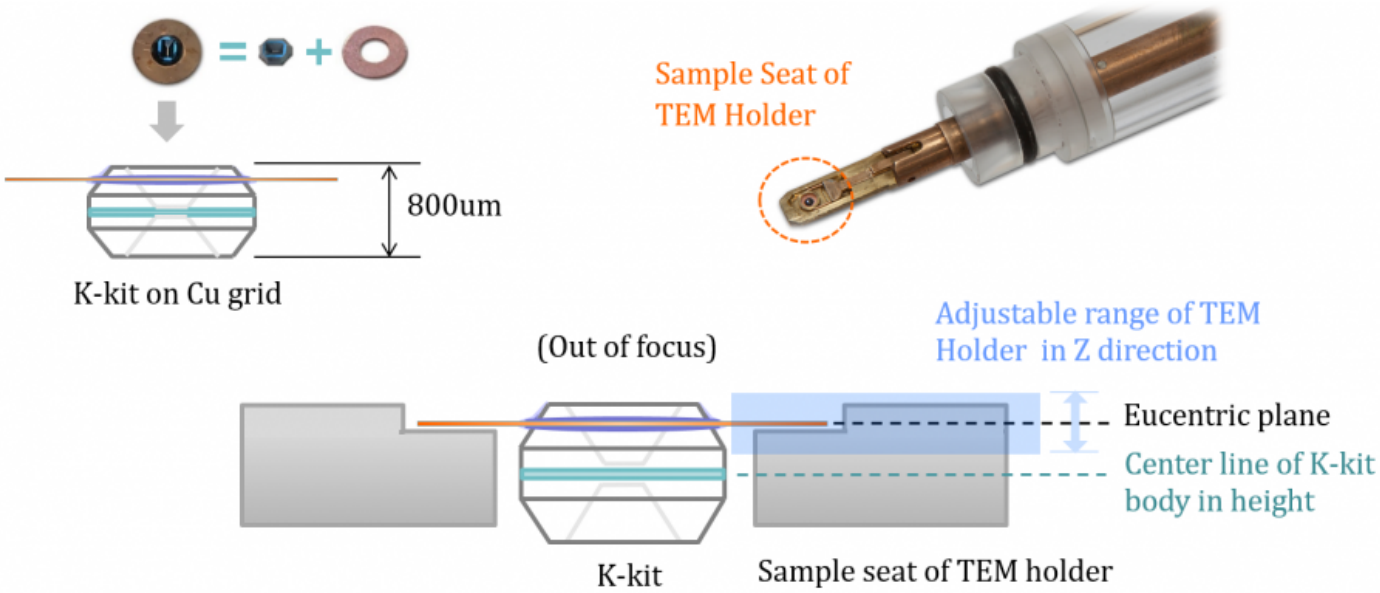
Frequently Asked Questions

Out of focus in TEM

If observing K-kits by some types of TEM like JEOL 2100, which is known with relatively small focus range just around ±110um in Z height, one will be possibly encountered the out-of-focus issue.



K-kit has a Silicon body of around 800um in thickness, so the plane of the Cu grid that mounted on K-kit is also with a certain distance to the center line of the K-kit body in height; if that distance is over the focusable Z-height range in TEM, the K-kit images will not be well focused.



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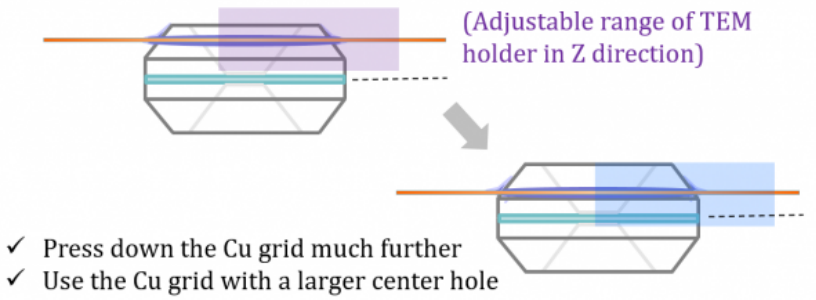
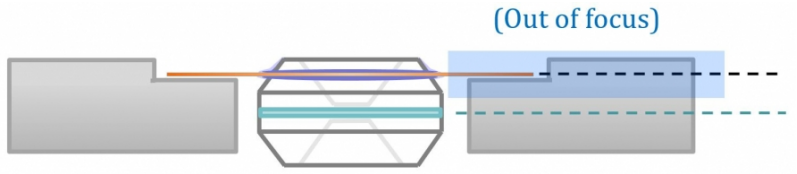
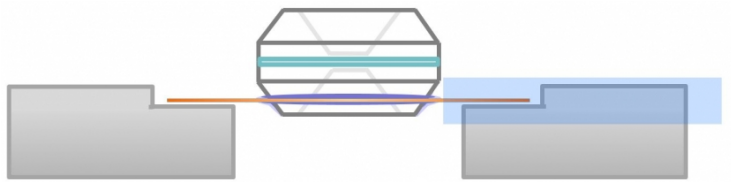


The solutions for the out-of-focus issue are suggested as below:

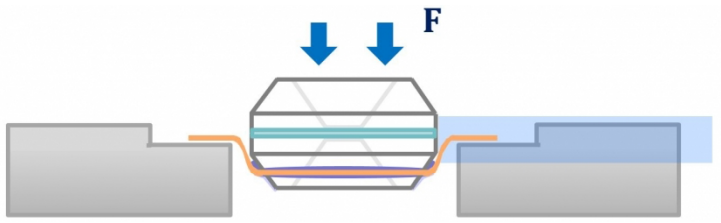
- Press down the Cu grid much further, as mounting it onto a glued K-kit.
- As placing a K-kit on the sample seat of TEM holder, one can use a tiny stick (such as a toothpick) to press the K-kit downward properly, for making the centerline of the K-kit body in height to fall within the focusable Z-height range of TEM. (Please refer to the schematic drawings below)
- To use the Cu grids with a larger diameter (e.g. 1.5mm) of center hole for K-kit. (Currently, we use the Cu grids with the center hole of 1.2mm in diameter)



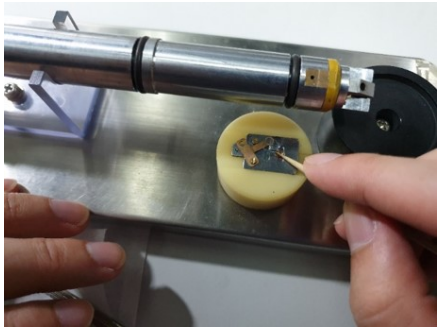
The centre line of the k-kit body is not on the eucentric plate.



Turn the other side upward on TEM holder.



Press the K-kit downward properly, making the centerline of K-kit body fall into the focusable range in Z direction.



Press down the K-kit by a tiny stick (e.g. toothpick)

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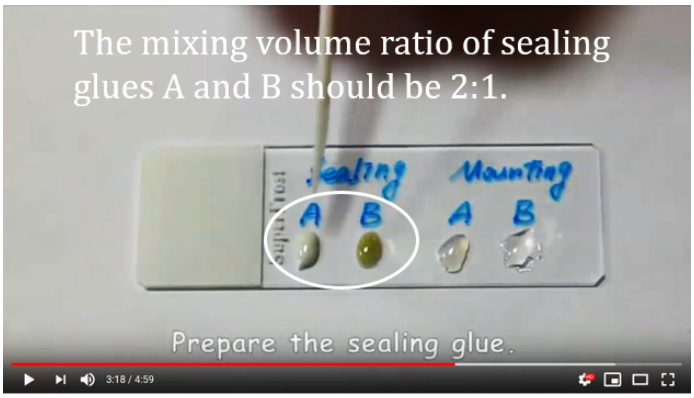
Poor curing of glue

Some K-kit customers responded that the sealing glues couldn't be fully cured by mixing the two component adhesives A and B; with the discussions with those users, we found that our tutorial video for K-kit sample preparation (https://youtu.be/LYTnFliM3Eg) actually delivers an incorrect demonstration, which shows the glue amounts of A and B components with the ratio 1:1 taken and mixed wrongly.



Please note that the sealing glues of A and B components should be taken by the volume ratio of 2:1 for mixing, not as shown of 1:1 in our current K-kit video; we are sorry for providing the wrong information and shall modify that video clip soon.

Storage issue of glue

Regarding the glue dried or discoloured issue, it is mainly caused due to the fact that either the glue standing in storage for too long after the sealed foil removed or the improper use by picking the two component adhesives A and B from their vials with the same picking stick, making it the cross-contamination of A and B glues easily induced.

The glues were dried or discolored, as standing in storage for too long.

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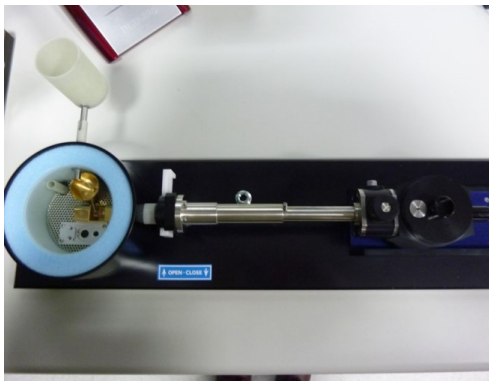
From our experience, one should use out the glue vials quickly better within two months after opening them. Meanwhile, it can be kept longer in storage, as attached the image if capping back the glue vial and surrounded sealing the joint seam of the cap with a waterproof adhesive tape. Currently, we are doing a test by adding a waterproof bedding layer on the inner side of the vial cap.

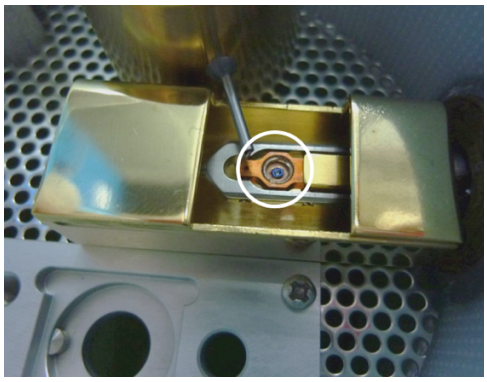
TEM Holder Issue

For some kinds of TEM holders, which by using a screwed ring further for clamping down the Cu grid, K-kit usually cannot be locked up to the sample seats of them. If you encounter any K-kit locking problems, please contact us.

The locking tool for FEI double-tilt holder that is compatible with K-kit.



Gatan cryo-transfer holder CT3500HT.



K-kit locked on the holder.