

19 - FIB accessories

Low profile pin stubs for FIB applications

These low profile aluminium pin stubs are available as flat or 90°, as well as with specific angles to accommodate specimens with small working distances in FIB applications. The 38° complimentary angle pin stub is suitable for FEI DualBeam™ and FIB systems, while the 36° complimentary angle pin stub is for Zeiss/Leo CrossBeam® and NVision systems. The stubs are fully compatible with standard pin stub mounts (3.2 mm diameter pin) for sample storage and transport. These stubs can also be used with adapters in Hitachi, JEOL and ISI systems.



12.7 mm dia
G3026 Flat pin stub. Pack of 10



12.7 mm dia
G3027 90° pin stub. Pack of 10



12.7 mm dia
G3028 38° pin stub. Pack of 10



12.7 mm dia, with 6 mm pin,
total height 7 mm
G3030 Flat pin stub. Pack of 10



12.7 mm dia, with 6 mm pin,
total height 9.15 mm
G3031 90° pin stub. Pack of 10



12.7 mm dia, with 6 mm pin,
total height 9.15 mm
G3029 36° pin stub. Pack of 10

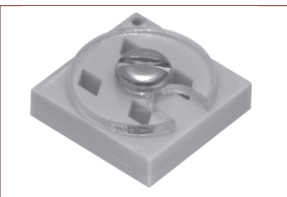
FIB lift-out grids



These are half-grid lift-out TEM sample holders for FIB applications, made of copper/beryllium. They are approximately 100 µm thick, and the slot is 2 mm wide and 0.5 mm deep. The sturdy holders offer easy handling and good protection for the TEM sample.

J460 FIB lift-out grids. Pack of 25

FIB grid storage box



A storage box for four FIB lift-out grids or half grids. Cavity depth is only 1.7 mm, thus preventing grids from rotating, and the diamond shaped cavities allow grids to be easily loaded or unloaded using fine tweezers.

G3719 FIB grid storage box

Omniprobe® consumables and accessories

Omniprobe lift-out grids

Omniprobe lift-out grids offer secure mounting of TEM lamellae milled by FIB or SEM/FIB systems. The grids are typically 25 - 30 µm thick, with posts designed to ensure reliable attachment of lamellae while providing an unobscured view of each section. All grids are 3 mm in diameter.



3 post lift-out grids

3 post lift-out grids designed for *in situ* lift-out. These grids include multiple indexed mounting locations, with both vertical bar and V-shaped attachment surfaces. Available in copper or molybdenum.

- J420** 3 post lift-out grids, copper. Box of 100
J421 3 post lift-out grids, molybdenum. Box of 25



4 post lift-out grids

4 post lift-out grids designed for *in situ* lift-out. These grids include multiple indexed mounting locations, two with vertical bar attachment surfaces and two with V-shaped alignment surfaces. The sides have a lower profile to allow easy access to the outermost posts. Available in copper or molybdenum.

- J423** 4 post lift-out grids, copper. Box of 100
J424 4 post lift-out grids, molybdenum. Box of 25



5 post lift-out grids

5 post copper lift-out grids are suitable for *in situ* lift-out. These grids include multiple indexed mounting locations, all with vertical bar attachment surfaces. They incorporate lower profile sides for easier access to the outermost posts.

- J422** 5 post lift-out grids, copper. Box of 100



Beryllium half-ring lift-out grids

Simple beryllium half-ring grid offering low etching rates for applications such as tripod polishing, FIB and ion milling. Beryllium ensures X-ray peaks from the grid do not interfere with EDS analysis.

- J425** Beryllium half-ring grids. Box of 10



Thinning coupons

Omniprobe copper TEM sample grid coupons of 45 and 26.5° are available for frontside and backside thinning. They have been designed specifically for use in Omniprobe's Short-Cut™ tool. The centre portion is a standard 3 mm grid, into which the needle loaded with a sample is swaged and cut.

- J440** 45° frontside thinning copper coupons. Box of 20
J441 45° backside thinning copper coupons. Box of 20
J443 26.5° frontside thinning copper coupons. Box of 20
J444 26.5° backside thinning copper coupons. Box of 20



Atom probe preparation coupons



These copper coupons have been designed to facilitate the preparation of atom probe samples using the Omniprobe's 45° Short-Cut™ tool. The half moon shaped centre grid of 3 mm can be cut at the detent to create a holder, with the sample protruding just beyond the peak of the grid edges.

J442 Atom probe preparation copper coupons. Box of 20

Lift-out grid storage box



The storage box holds up to 100, horizontally stored, standard 3 mm lift-out TEM grids, and comes complete with base, lid and clips.

J430 Lift-out grid storage box

Tungsten probe tips and tip holders

Tungsten probe tips are available for Omniprobe nanomanipulators.

Standard probe tips



Standard probe tips are available as all-tungsten or with nickel shanks, and have a taper angle designed to ensure extended life.

J410 Nickel shank, tungsten probe tips, tip radius 0.5 µm, 13° taper angle. Box of 10



J411 All-tungsten probe tips, tip radius <0.5 µm, 10 - 13° taper angle. Pack of 10

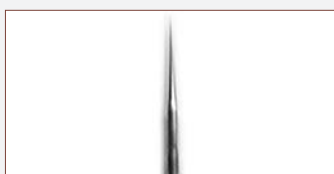
Probe tips and tip holders for AutoProbe™ instruments

These tungsten probe tips for the AutoProbe 300 nanomanipulator have been designed to allow speedy *in situ* probe tip exchange and are compatible with the Short-Cut tool. The AP250 probe tip is also compatible with the Short-Cut tool for direct conversion to TEM grids. *In situ* tungsten probe tips for an AutoProbe 300 fitted to an FEI Helios 1200 are also available.

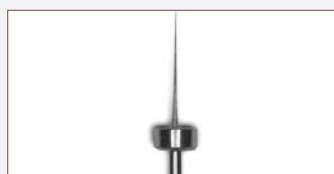
The AP250 probe point holder has been designed to hold the AP250 tungsten probe tip (**J413**). It is compatible with the Short-Cut tool for direct conversion to TEM grids. The holder is supplied with a storage vial.



J412 AP300 tungsten probe tips. Box of 20. Tip radius 0.5 µm, 8 - 10° taper angle.



J413 AP250 probe tips. Box of 10. Tip radius <0.5 µm, 10° taper angle.



J415 AP300-Helios 1200 probe tips. Box of 20. Tip radius 0.5 µm, 10° taper angle.



J456 AP250 probe point holder

TEM grid/sample holders

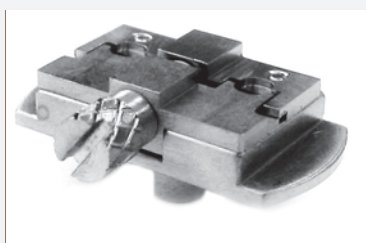
TEM grid holders with short posts of standard 3.2 mm diameter are available. The TEM grid/sample holder has workstations for two TEM grids and with either one or two sample pucks. The stainless steel holders are very slightly magnetic. Non-magnetic versions of each of these holders are also available.

The pivoting TEM grid holder has workstations for two TEM grids and allows manual adjustment of the grid holder plate to obtain the optimal milling incidence angle, even when at the FIB stage tilt limit. The TEM plate angle is manipulated *in situ*, using the tip of an empty AutoProbe 300 gripper shaft. The pivoting grid holder is non-magnetic.

The single sample holder accommodates a 3 mm TEM grid, and has raised edges that have been designed to protect samples from accidental damage. The single sample holder can be mounted on the sample holder base, which allows samples to be viewed under a stereomicroscope from two angles without focus adjustment.

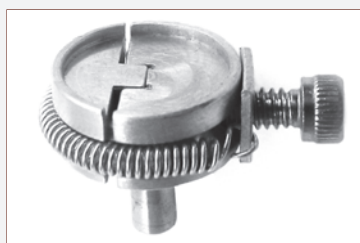
Short post TEM holders 3.2 mm dia x 4 mm length.

Long post TEM holders 3.2 mm dia x 8.1 mm length.



J400 TEM grid holder, stainless steel

J401 TEM grid holder, non-magnetic



J404 Single sample holder



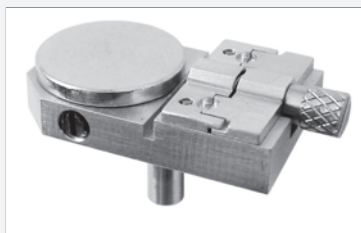
J405 Sample holder base

Long post TEM holders 3.2 mm dia x 8.1 mm length.



J407 TEM grid/sample holder,
1 sample puck, stainless steel

J406 TEM grid/sample holder,
1 sample puck, non-magnetic



J408 Pivoting TEM grid holder



J402 TEM grid/sample holder,
2 sample pucks, stainless steel

J403 TEM grid/sample holder,
2 sample pucks, non-magnetic

Probe tips and tip holders for Xtreme Access™ instruments

All-tungsten probe tips for the Xtreme Access are available as standard, and Short-Cut compatible versions for direct conversion to a TEM grid. The probes have a tip radius of $<0.5 \mu\text{m}$ and a taper angle designed for maximum lifetime.

The Xtreme Access probe point holder has been designed to hold the Xtreme Access 1/2" tungsten probe tip (**J450**) and is supplied with a storage vial.

J450 Xtreme Access tungsten probe tips, 10° taper angle. Box of 10



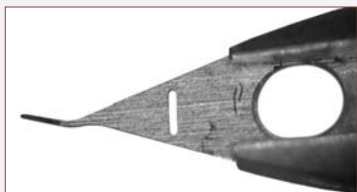
J414 Xtreme Access Short-Cut probe tips,
6° taper angle. Box of 10



J455 Xtreme Access probe point holder

End effectors

Type 2 curved end effectors designed for low attack angle manipulation and lift-out are available in molybdenum and copper. The shank is curved to permit low angle approach and solid attachment beneath the sample plane without collision with the surrounding matrix. Type 3 straight end effectors are also available in molybdenum and copper for the Xtreme Access™ probe shaft.



Curved end effectors

- J451** End effector Mo type 2. Box of 12
- J452** End effector Cu type 2. Box of 12



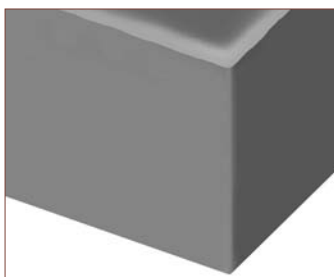
Straight end effectors

- J453** End effector Mo type 3. Box of 12
- J454** End effector Cu type 3. Box of 12

FIB and ion beam standards

These are high precision ion sputter standards suitable for the set-up and calibration of ion sputter guns. Thin films of silicon dioxide, silicon nitride, tantalum pentoxide and nickel/chromium are available.

Silicon dioxide (SiO₂)



Silicon wafers (4") with thin films of silicon dioxide are available in thicknesses of 23, 50, 97 and 102.9 nm. The oxide films are grown with a wet oxygen process, which ensures a higher degree of uniformity than other processes.

- S1804-1** Silicon dioxide ion sputter standard, 23 nm ± 0.23 nm
- S1804-2** Silicon dioxide ion sputter standard, 50 nm ± 2.5 nm
- S1804-3** Silicon dioxide ion sputter standard, 97 nm ± 3.8 nm
- S1804-4** Silicon dioxide ion sputter standard, 102.9 nm ± 2.5 nm

Silicon nitride (Si₃N₄)

100 nm silicon nitride (CVD) films deposited on a piece of silicon wafer, 1 x 3 cm.

- S1805** Silicon nitride ion sputter standard

Tantalum pentoxide (Ta₂O₅)

Films of tantalum pentoxide (approximately 100 nm) are anodically grown on 0.5 mm thick tantalum foil. Thickness accuracy is approximately 5 %. Size of standard, 37 x 37 mm.

- S1806** Tantalum pentoxide ion sputter standard

Nickel/chromium (Ni/Cr)

This standard consists of 12 alternating layers: six layers of chromium approximately 53 nm thick, and six layers of nickel 64 nm thick on a silicon wafer. The total thickness is 700 nm with a maximum variation across the 75 mm production wafer of ± 2 %. The section of polished silicon wafer is 1 x 3 cm. The mass density of the chromium and nickel was determined using electron beam excitation and then by measuring characteristic X-ray intensities.

- S1807** Nickel/chromium ion sputter standard

Critical dimension (CD) calibration test specimens

A CD calibration test specimen is of particular interest to microscopists and test engineers using high performance SEMs for critical measurement of semiconductor line width dimensions.

The 4.8 x 4.8 mm silicon standard has a series of chequerboard patterns around its edges with a side length of 480 µm. These can be used for optimising imaging parameters and checking distortion.

The central region of the standard contains a series of five line patterns, each one clearly identified with its pitch size. Each pattern is made up of five bars and spaces of equal width. Bar pitch for the

individual patterns ranges in size from 0.5 - 10 µm for calibrating intermediate size structures and 100 - 500 nm for smaller structures. Each standard is identified by a unique serial number.

The test specimen is available non-certified, or certified by the German Physikalisch-Technische Bundesanstalt. For certified standards, each pitch is measured and a mean value calculated from a series of five measurements. Measurements were made on a dedicated CD measuring system fitted to an FEG SEM at an accelerating voltage of 700 eV.

10-5-2-1-0.5 µm structure

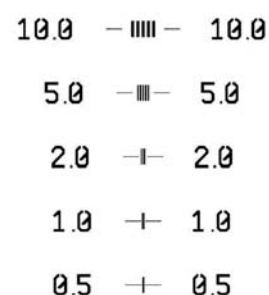
This CD calibration test specimen comprises five line patterns, each one clearly identified by its pitch. Each pattern has five bars and spaces of equal pitch: 10, 5, 2, 1 and 0.5 µm. The central line area may also be used for AFM measurements. The patterns are etched into silicon with a depth of approximately 200 µm. There is no coating on the silicon surface.

S1995A CD calibration specimen, 10-5-2-1-0.5 µm, non-certified

S1997A CD calibration specimen, 10-5-2-1-0.5 µm, certified

Each standard is identified by a unique serial number.

The specimen can be supplied unmounted or mounted on any of the standard range of SEM stubs. Please specify.



500-200-100 nm structure

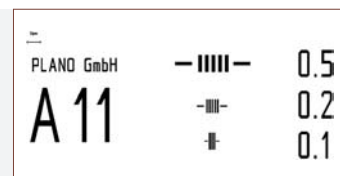
This advanced CD calibration test specimen is suitable for calibrating smaller structures. It comprises three line patterns, each identified by its pitch. Each pattern has five bars and spaces of equal pitch: 500, 200 and 100 nm. The central line area may be used for AFM measurements. The patterns are etched into silicon with a depth of approximately 45 - 50 nm. There is no coating on the silicon surface.

S1998 CD calibration specimen, 500-200-100 nm, non-certified

S1998A CD calibration specimen, 500-200-100 nm, certified

Each standard is identified by a unique serial number.

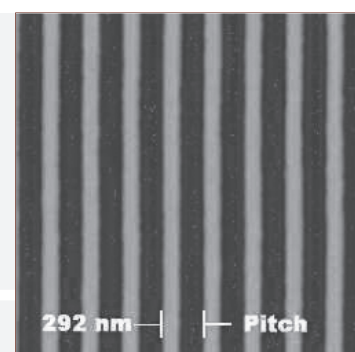
The specimen can be supplied unmounted or mounted on any of the standard range of SEM stubs. Please specify.



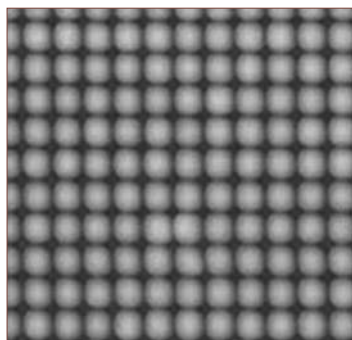
High magnification, high resolution calibration reference and traceable standards for SEM, AFM, Auger and FIB

These precision, holographic patterns are highly accurate and stable, with moderate ridge heights that are convenient for AFM. This specimen also provides excellent contrast for secondary and back-scatter imaging with SEM. It provides accurate calibration for high resolution, nanometre-scale measurements. Available with 70, 145 and 292 nm pitch.

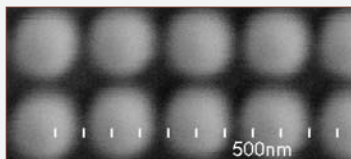
For details of these calibration standards, please refer to section 3, pages 63 - 65.



2-D holographic array standards



A series of 2-D standards is available providing accurate calibration in the horizontal plane for very high resolution, nanometre-scale measurements and is suitable for use in FIB instruments.



For details of this range of calibration standards, please refer to section 3, pages 61 - 62.

MetroChip calibration standard



The MetroChip microscope calibration standard provides an extensive range of features for SEM, FIB, AFM, light microscopy and metrology systems calibration. It is supplied on a 20 x 20 mm chip with a thickness of 750 µm, with periodic features for enhanced calibration in the range 4 mm down to 100 nm.

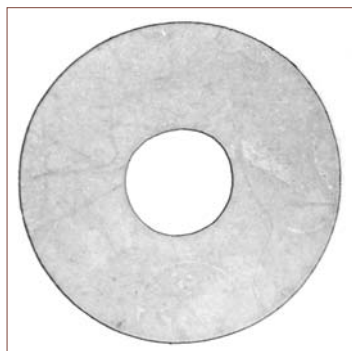
The SEM calibration feature includes alignment marks, linear microscale, distortion measurements, paraxial calibration (image shift), resolution measurements, focus star, stigmator calibration, gratings, concentric circles and squares. The combination of these features on one standard makes the MetroChip ideal as an all-in-one standard both for initial set-up and regular calibration checks. Due to its composition the chip exhibits minimal charging and, if cared for properly, a long sample life.

The MetroChip can also be used for light microscopy and AFM and includes a number of features to check linearity, distortion and scan length.

The MetroChip standard is easy to navigate and comes with dimension labels on most features. It is fully traceable to NIST certification.

S1949 MetroChip calibration standard, certified

Diamond grids



Diamond grids are made of pure synthetic diamond, and are used with heat sensitive samples. They offer exceptional performance for FIB and conventional ion milling, ensuring heat is rapidly carried away from the specimen thanks to their very high thermal conductivity (four times higher than copper) and resistance to the milling process. Diamond grids are also highly suited to analytical TEM studies, due to their very low Bremsstrahlung background radiation levels. They offer comparable performance to beryllium grids, without the associated safety and toxicity issues. Individually packed grids are 3 mm diameter and 40 µm thick.

G2982 Diamond hole grid, 1000 µm

G2983 Diamond slot grid, 2 x 1 mm slot

SEMGLU



This high vacuum compatible SEM adhesive hardens under electron beam irradiation. Using relatively low imaging currents, the glue remains uncured. Polymerisation begins only when focusing the electron beam on a very small area of glue. Setting yields an excellent bond with adhesive forces comparable to those obtained with epoxy-based glues. It is excellent for securing FIB lamellae to grids. SEMGLU is shipped ready to use on a stub.

SEMGLU Kleindiek SEMGLU

LOCTITE® 460 sample bonding adhesive

Loctite 460 is a fast curing, low odour, low viscosity glue which can be used as an alternative to wax for mounting samples on glass for TEM/FIB thinning. Functional bond strength develops in a short time and is fully cured within 24 hours. Loctite 460 is soluble in acetone. This product also provides rapid bonding of a wide range of other materials, including metals, plastics and elastomers. It is particularly suited for bonding porous or absorbent materials such as wood, paper, leather and fabric.

G3204 Loctite 460 adhesive. 20 g *Irritant*



M-Bond™ 610 adhesive

M-Bond 610 is a non-conductive, two-component, solvent-thinned epoxy-phenolic adhesive for high performance applications. It is chemically resistant and provides a thin layer of glue which has good ion milling properties. It is an excellent adhesive for mounting samples for dimpling grinding and for bonding samples to produce high quality cross-sections for TEM or for FIB applications. It has also been found to be useful for bonding specimens to mounts for Vibratome™ sectioning. M-Bond has an extremely wide operating temperature range. The complete kit contains four 14 g bottles of resin, four 11 g bottles of curing agent, four brush caps for dispensing mixed adhesives, four disposable mixing funnels and a sheet of instructions.

The single mix kit comprises one bottle of resin (14 g), one bottle of curing agent (11 g), one brush cap for dispensing mixed adhesive and a disposable mixing funnel.

G3203 M-Bond 610. Single kit *Flammable, irritant*

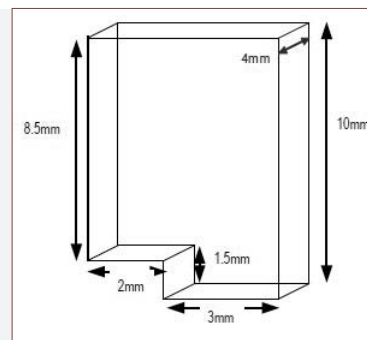
G3207 M-Bond 610. Complete kit *Flammable, irritant*



FIB SEM mould for biological specimens

This silicon rubber mould has been developed in collaboration with Cancer Research UK's London Laboratories. The mould is designed to aid in orientation and trimming of the sample. It produces a block which is easy to mount in the SEM for correct orientation of the block face with respect to the ion and electron beams. During FIB milling, re-deposition of sputtered material back onto the block face is minimised by positioning the sample in an overhang of resin. This four-cavity mould can also be reused many times if handled with care.

G3504 FIB SEM mould



Chien staining pad

Although this flexible silicone pad was originally designed for staining grids, it is also useful for holding Omniprobe® grids and samples and has the added advantage that even when the pad is flexed the grids do not fall over. It is 50 mm in diameter and 5 mm thick, with 18 slots.

G3766 Chien staining pad

