

2 - Support films and substrates

Film-forming materials

Support films can be prepared from many different materials, the more commonly used being plastics, evaporated carbon or silicon monoxide. However the final choice of material depends on the nature of the specimen to be examined.

Plastic films are inexpensive and convenient but can be decomposed by the electron beam and therefore are liable to move slightly when first irradiated. This makes them unsuitable for high resolution work. Carbon and silicon monoxide films have greater mechanical strength and stability under the beam when compared to plastic films.

Ready-made film-coated substrates are also available (see pages 27 - 36). For TEM applications up to 100 kV, we offer Pioloform® and Formvar® coated grids without a carbon layer. A range of high quality Formvar/carbon films, which are cast thin films of Formvar strengthened by a thin evaporated carbon layer, are highly electron

transparent and have fine grain and low contrast to augment specimen structure images. Also available is a range of lacey carbon and holey carbon films, ideal for looking at acicular crystals and biological/materials specimens.

Silicon monoxide, silicon dioxide or silicon nitride films can be used where a non-carbon support film is required. Pure silicon films provide a stable support and the greatest transparency for TEM applications.

LUXFilm™ TEM supports have been developed for demanding TEM imaging of thick sections in the 80 - 300 kV range.

Metallic substrates are also offered to meet a wide range of applications, providing higher surface energy compared to carbon support films.

Film-forming solutions



A variety of film-forming solutions are available to prepare support films and replicas of smooth surfaces.

Formvar® (polyvinyl formal) is normally used as a 0.25 % solution in chloroform. The thickness and stability of the film can be altered by adjusting the concentration between 0.25 % and 0.5 %.

Pioloform® is polyvinyl butyral dissolved in chloroform (0.3 - 1.5 %). The solution should be stored in a refrigerator in an amber glass bottle, and brought up to room temperature before use.

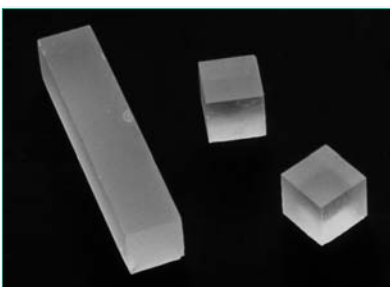
Butvar® B98 is a polyvinyl butyral resin containing 20 % polyvinyl alcohol, and is normally used as a 0.25 % solution in chloroform. It is an alternative support film to Formvar as reported by Handley and Olsen, *Ultramicroscopy* 4, p479 - 480, 1979. Films made from Butvar are hydrophilic, and are therefore suitable for negative staining methods, having good mechanical stability, high electron transparency and minimum intrinsic structure. Butvar B98 can also be applied to grids as an adhesive.

- R1202** Formvar. 25 g
- R1201** Formvar. 100 g
- R1275** Pioloform. 10 g
- R1276** Butvar B98. 25 g
- R1277** Silicon monoxide. 10g

Other replica making materials

See Materials science specimen preparation, pages 292 - 293.

Crystal substrates

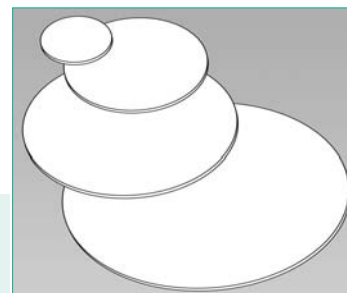


High purity optical grade single crystals of sodium chloride, potassium bromide and potassium chloride are excellent substrates for growing epitaxial films. These crystals are ideal for thin film research and are excellent substrates on which to evaporate metals. For most applications it is advisable to use only freshly cleaved substrates. Pieces of 1 - 2 mm thickness can be cleaved to be used as substrates. The cleaved surfaces produce atomically flat areas however cleavage steps over different atomic planes should be expected. The material is supplied as 10 mm square crystals of (100) orientation.

- G3900** Potassium bromide crystal, 10 x 10 x 50 mm
- G3941** Sodium chloride crystal, 10 x 10 x 50 mm
- G3979** Potassium chloride crystals, 10 x 10 x 10 mm. Pack of 5

Quartz substrate discs

Quartz discs, or wafers, are made from high quality fused quartz, ground and polished to optical grade on both sides. The discs are ideal for use as substrates for thin film research and are also suitable for many optical applications. Quartz wafers have excellent chemical resistance against a wide variety of solvents, as well as exceptional heat resistance, with high dimensional stability over a wide temperature range. They are available in sizes from 1" (25.4 mm) to 4" (102 mm) with thickness of 1/16" (1.59 mm) and 1/8" (3.18 mm).

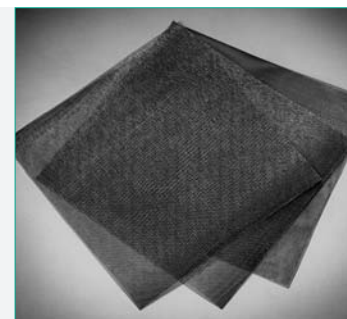


Type	Thickness	
	1/16"	1/8"
Quartz disc, 1" (25.4 mm) dia	G3708-1	G3708-2
Quartz disc, 2" (50.8 mm) dia	G3708-3	G3708-4
Quartz disc, 2.5" (63.5 mm) dia	G3708-5	G3708-6
Quartz disc, 3" (76.2 mm) dia	G3708-7	G3708-8
Quartz disc, 4" (102 mm) dia	G3708-9	G3708-10

Stainless steel mesh

Stainless steel mesh in 150 mm squares, suitable for supporting grids during specimen preparation. Can be cut with strong scissors to any required size.

G252 Wire mesh. 3 sheets



Microscope slides

These high grade slides with ground and polished edges have been pre-cleaned and are suitable for casting Formvar, Pioloform or Butvar films.

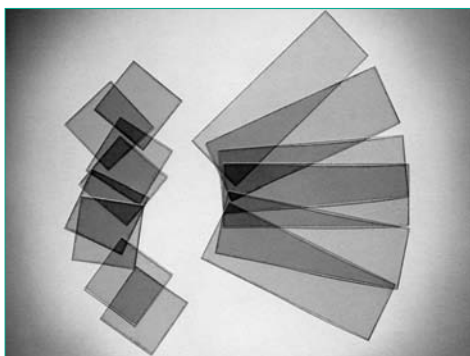
G251P Slides, 76 x 26 mm, 1.2 - 1.5 mm thick. Box of 50



Other microscope slides

For full range of microscope slides, see Light microscope accessories, page 145.

Mica



Freshly cleaved ruby muscovite mica surfaces are extremely even and flat. They are also quite transparent and free from scratches and contamination. Cleaved mica is traditionally used in electron microscopy for the production of carbon support films, cell growing and thin film coating research. Ruby muscovite mica surfaces are also suitable as substrates for high resolution atomic force microscopy studies.

The mica cleaving process involves insertion of a sharp edge or point into an edge or corner of the mica sheet and gently separating the natural layers of the mica. A thin double edged razor blade is extremely good for this purpose.

The freshly exposed cleaved surface should be used immediately to utilise the clean and even surface. The starting thickness of the mica sheets varies between 0.10 - 0.25 mm.

Ruby muscovite is a hard material with excellent cleaving properties. It has a minimal tendency to cracking and splits more easily into thin films along natural cleavage planes.

- G250-3** Mica 11 x 11 mm, 0.15 mm thick. Pack of 20
- G250-2** Mica 25 x 25 mm, 0.15 mm thick. Pack of 20
- G250-1** Mica 75 x 25 mm, 0.15 mm thick. Pack of 20
- G250-4** Mica 100 x 20 mm, 0.15 mm thick. Pack of 20
- G250-5** Mica 150 x 150 mm, 0.15 mm thick. Pack of 3
- G250-6** Mica 9.9 mm dia, 0.1 mm thick, ultra-clean. Pack of 10
- G250-7** Mica 20 x 20 mm, 0.25 mm thick ultra-clean. Pack of 10

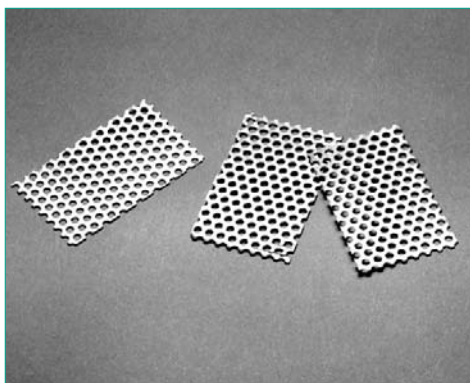
Other sizes are available on request.

Glass Pasteur pipettes



- G257** Pasteur pipettes, short form, 145 mm. Box of 250
- G259** Pasteur pipettes, long form, 230 mm. Box of 250
- G258** Rubber bulbs for pipettes, 2 ml. Box of 10

Grid coating plates



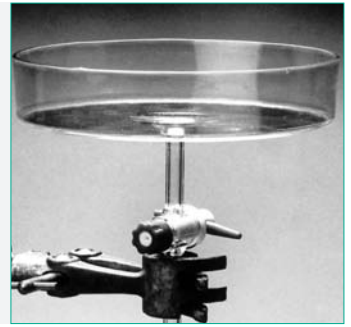
Made from nickel plate, these can accommodate up to fifty 3.05 mm grids. They are very useful in the preparation of Formvar® and other support films. The plate is placed under distilled water and the surface supporting the film gradually lowered. Excess water is removed by blotting from below. The plate containing filmed grids can be transferred to a vacuum coating unit for carbon coating once dry.

- G3653** Grid coating plates, 30 x 50 mm. Pack of 3

Settlement dish

Settlement dish, 135 mm diameter, with drain tap. Useful for removing distilled water when preparing plastic support films, or for floating down stripped carbon films on to TEM grids.

G341 Settlement dish



Glass Petri dishes

Glass Petri dishes with lids are available in borosilicate or Pyrex® glass. The dishes are available singly.

- G3903** Petri dish, borosilicate, 55 mm dia
- G3904** Petri dish, borosilicate, 74 mm dia
- G3905** Petri dish, borosilicate, 94 mm dia
- G3906** Petri dish, Pyrex, 55 mm dia
- G3907** Petri dish, Pyrex, 74 mm dia
- G3908** Petri dish, Pyrex, 94 mm dia

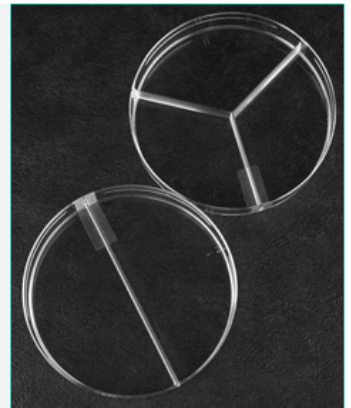


Compartmented Petri dishes

These Petri dishes originally designed for segregating different culture media are very useful for keeping small quantities of samples and specimens. They are CE marked, sterile and manufactured under clean room conditions (ISO 14644, class 7) to exclude microbiological contamination. The dishes are available with two or three compartments.

Supplied in sterile packs.

- G3948-2** Petri dish, two-compartment, 90 mm dia. Pack of 20
- G3948-3** Petri dish, three-compartment, 90 mm dia. Pack of 20



Ready made film coated grids

We offer ready made film coated grids. All our support films are prepared to the highest possible standards ensuring optimum cleanliness and a minimum of broken grid squares. Each film coated grid is optically checked followed by a batch check in the TEM. All films shown are prepared on 3.05 mm grids. 2.3 mm grids can be prepared on request.

Pioloform® films

Pioloform coated grids without a carbon layer are suitable for TEM applications up to 100 kV. Pioloform is sometimes preferred to Formvar® because of its higher mechanical and thermal stability, and lower bulk which can help reduce electron scattering.

Supplied as 25 grids in a grid box.

Type	Copper	Nickel	Gold
Pioloform on 75 mesh	S134-6	S134N6	S134A6
Pioloform on 100 mesh	S134-1	S134N1	S134A1
Pioloform on 200 mesh	S134	S134N	S134A
Pioloform on 300 mesh	S134-3	S134N3	S134A3
Pioloform on 400 mesh	S134-4	S134N4	S134A4
Pioloform on slot 2 x 1 mm	S134-5	S134N5	S134A5
Pioloform on F1 finder grid	S134-F1	S134NF1	S134AF1
Pioloform on H7 finder grid	S134-H7	S134NH7	S134AH7

Formvar® films

Formvar coated grids without a carbon layer are suitable for TEM applications up to 100 kV. The films are available on grids made of copper, nickel or gold.

Supplied as 25 grids in a grid box.

Type	Copper	Nickel	Gold
Formvar on 75 mesh	S138-6	S138N6	S138A6
Formvar on 100 mesh	S138-1	S138N1	S138A1
Formvar on 200 mesh	S138	S138N	S138A
Formvar on 300 mesh	S138-3	S138N3	S138A3
Formvar on 400 mesh	S138-4	S138N4	S138A4
Formvar on slot 2 x 1 mm	S138-5	S138N5	S138A5
Formvar on F1 finder grid	S138-F1	S138NF1	S138AF1
Formvar on H7 finder grid	S138-H7	S138NH7	S138AH7

Formvar/carbon films

These thin cast films of Formvar have been strengthened with the addition of a layer of evaporated carbon. The composite films have extra resilience and strength compared with carbon films. They are recommended for use where the grid has to undergo several processing steps during specimen preparation.

Supplied as 25 or 50 grids in a grid box.

Type	Copper	Nickel	Gold
Formvar/carbon on 75 mesh. Box of 50	S162-6	S162N6	S162A6
Formvar/carbon on 75 mesh. Box of 25	S162-6H	S162N6H	S162A6H
Formvar/carbon on 100 mesh. Box of 50	S162-1	S162N1	S162A1
Formvar/carbon on 100 mesh. Box of 25	S162-1H	S162N1H	S162A1H
Formvar/carbon on 200 mesh. Box of 50	S162	S162N	S162A
Formvar/carbon on 200 mesh. Box of 25	S162H	S162NH	S162AH
Formvar/carbon on 300 mesh. Box of 50	S162-3	S162N3	S162A3
Formvar/carbon on 300 mesh. Box of 25	S162-3H	S162N3H	S162A3H
Formvar/carbon on 400 mesh. Box of 50	S162-4	S162N4	S162A4
Formvar/carbon on 400 mesh. Box of 25	S162-4H	S162N4H	S162A4H
Formvar/carbon on slot 2 x 1 mm. Box of 50	S162-5	S162N5	S162A5
Formvar/carbon on slot 2 x 1 mm. Box of 25	S162-5H	S162N5H	S162A5H
Formvar/carbon on F1 finder grid. Box of 50	S162-F1	S162NF1	S162AF1
Formvar/carbon on F1 finder grid. Box of 25	S162-F1H	S162NF1H	S162AF1H
Formvar/carbon on H7 finder grid. Box of 50	S162-H7	S162NH7	S162AH7
Formvar/carbon on H7 finder grid. Box of 25	S162-H7H	S162NH7H	S162AH7H

Carbon films

This range of carbon films has been prepared to provide a very convenient, ready-to-use specimen support. Carbon films are thin and highly transparent to electrons, offering fine grain and low contrast that does not interfere with specimen structure.

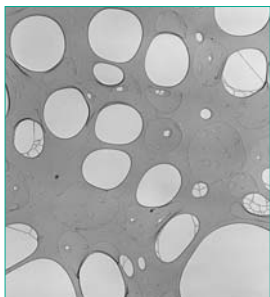
Supplied as 25 or 50 grids in a grid box.

Type	Copper	Nickel	Gold
Carbon film on 200 mesh. Box of 50	S160	S160N	S160A
Carbon film on 200 mesh. Box of 25	S160H	S160NH	S160AH
Carbon film on 300 mesh. Box of 50	S160-3	S160N3	S160A3
Carbon film on 300 mesh. Box of 25	S160-3H	S160N3H	S160A3H
Carbon film on 400 mesh. Box of 50	S160-4	S160N4	S160A4
Carbon film on 400 mesh. Box of 25	S160-4H	S160N4H	S160A4H
Carbon film on F1 finder grid. Box of 50	S160-F1	S160NF1	S160AF1
Carbon film on F1 finder grid. Box of 25	S160-F1H	S160NF1H	S160AF1H
Carbon film on H2 finder grid. Box of 50	S160-H2	S160NH2	S160AH2
Carbon film on H2 finder grid. Box of 25	S160-H2H	S160NH2H	S160AH2H
Carbon film on H7 finder grid. Box of 50	S160-H7	S160NH7	S160AH7
Carbon film on H7 finder grid. Box of 25	S160-H7H	S160NH7H	S160AH7H

Special support films

A range of specialist support films made on a variety of substrates are available upon request. Please call us for a quote or to discuss your requirements.

Holey carbon films



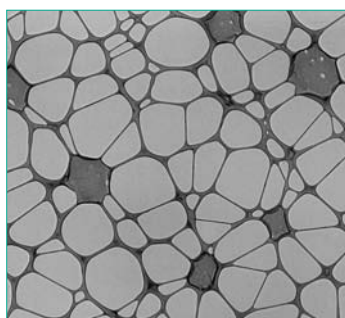
Holey carbon films have many uses in microscopy but for certain applications the mesh sizes of standard TEM grids are too large to support the sample. Continuous carbon films can also be a problem due to the fact that the thin film can inelastically scatter electrons and contribute to background noise. Holey carbon films therefore are a suitable alternative.

Holey carbon films have holes of various sizes up to 100 μm . In addition to providing support, the increased image contrast in the regions of the holes compared to regions of film is also of benefit. Typical applications include biological and materials science and cryo-TEM.

Supplied as 25 or 50 grids in a grid box.

Type	Copper	Nickel	Gold
Holey carbon film on 300 mesh. Box of 50	S147-3	S147N3	S147A3
Holey carbon film on 300 mesh. Box of 25	S147-3H	S147N3H	S147A3H
Holey carbon film on 400 mesh. Box of 50	S147-4	S147N4	S147A4
Holey carbon film on 400 mesh. Box of 25	S147-4H	S147N4H	S147A4H
Holey carbon film on H7 finder grid. Box of 50	S147-H7	S147NH7	S147AH7
Holey carbon film on H7 finder grid. Box of 25	S147-H7H	S147NH7H	S147AH7H

Lacey carbon films



Lacey carbon films are similar to the holey carbon films in that they have open areas but because of the fine lacey mesh structure they offer a greater percentage of open area in comparison (see micrograph). They provide the thinnest possible support film while maintaining adequate strength and give practically no background interference in the TEM. As much of the specimen is unsupported, these films are appropriate for use where a structure free background is of importance. Lacey carbon films are particularly suitable for studying some nanotubes, acicular crystals and biological/materials specimens.

Supplied as 25 or 50 grids in a grid box.

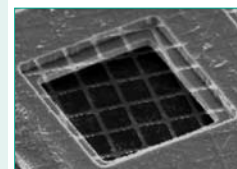
Type	Copper	Nickel	Gold
Lacey carbon film on 300 mesh. Box of 50	S166-3	S166N3	S166A3
Lacey carbon film on 300 mesh. Box of 25	S166-3H	S166N3H	S166A3H
Lacey carbon film on 400 mesh. Box of 50	S166-4	S166N4	S166A4
Lacey carbon film on 400 mesh. Box of 25	S166-4H	S166N4H	S166A4H
Lacey carbon film on H7 finder grid. Box of 50	S166-H7	S166NH7	S166AH7
Lacey carbon film on H7 finder grid. Box of 25	S166-H7H	S166NH7H	S166AH7H

Quantifoil® holey carbon films

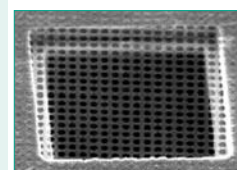
Quantifoils, produced by semiconductor lithographic techniques, are 15 - 20 nm thick perforated carbon films with precise, well defined hole sizes, shapes and arrays. Quantifoil support films provide a high percentage of open area in addition to minimising total specimen thickness. Object distortions arising from interactions with the support film are also reduced. They are particularly suited for cryo applications, tomography and low dose microscopy (LEEP).

Quantifoils are supplied as 10 grids in a grid box.

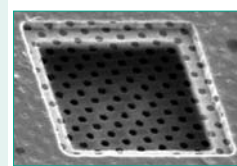
Type	Copper	Nickel	Gold
Square, hole size 7 x 7 μm , bar width 2 μm			
on 200 mesh grid	S117-1	S117-4	S117-7
on 300 mesh grid	S117-2	S117-5	S117-8
on 400 mesh grid	S117-3	S117-6	S117-9
Circular, hole size 1.2 μm dia, separation 1.3 μm			
on 200 mesh grid	S143-1	S143-4	S143-7
on 300 mesh grid	S143-2	S143-5	S143-8
on 400 mesh grid	S143-3	S143-6	S143-9
Circular, hole size 2 μm dia, separation 2 μm			
on 200 mesh grid	S173-1	S173-4	S173-7
on 300 mesh grid	S173-2	S173-5	S173-8
on 400 mesh grid	S173-3	S173-6	S173-9
Circular, hole size 1 μm dia, separation 4 μm			
on 200 mesh grid	S176-1	S176-4	S176-7
on 300 mesh grid	S176-2	S176-5	S176-8
on 400 mesh grid	S176-3	S176-6	S176-9
Circular, hole size 2 μm dia, separation 1 μm			
on 200 mesh grid	S174-1	S174-4	S174-7
on 300 mesh grid	S174-2	S174-5	S174-8
on 400 mesh grid	S174-3	S174-6	S174-9
Circular, hole size 2 μm dia, separation 4 μm			
on 200 mesh grid	S175-1	S175-4	S175-7
on 300 mesh grid	S175-2	S175-5	S175-8
on 400 mesh grid	S175-3	S175-6	S175-9
Circular, hole size 3.5 μm dia, separation 1 μm			
on 200 mesh grid	S177-1	S177-4	S177-7
on 300 mesh grid	S177-2	S177-5	S177-8
on 400 mesh grid	S177-3	S177-6	S177-9



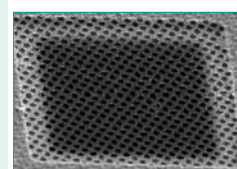
S117-1



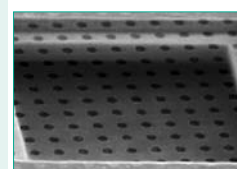
S143-1



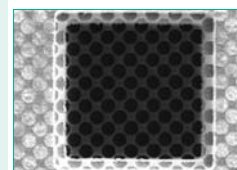
S173-1



S174-1



S175-1



S177-1

Other hole shapes and patterns are available and can be supplied on a range of TEM grids. Please ask for details.

Ultra-smooth carbon foils

Ultra-smooth carbon foils, manufactured by ACF Metals, have been prepared in ultra-clean conditions to yield films that are effectively structureless when viewed at high magnifications in the EM. In addition they come free of any contaminant particles. They form ideal substrates for the examination of fine particle materials where the absence of confusing background information can be vital. The foils are supplied in packs of two, mounted on mica sheets and can be provided in any thickness specified by the user. The foils can be floated off onto a clean water surface and have sufficient area to cover about 100 grids.

Cat. no.	Nominal thickness (nm)	Min-max thickness (nm)
S116-1	2.5	2.0 - 3.0
S116-2	3.5	3.1 - 4.0
S116-3	5.0	4.1 - 6.0
S116-4	7.0	6.1 - 8.0
S116-5	10.0	8.1 - 12.0
S116-6	15.0	12.1 - 17.0
S116-7	20.0	17.1 - 22.0
S116-8	25.0	22.1 - 27.0
S116-9	30.0	27.1 - 33.0
S116-10	40.0	35.1 - 45.0
S116-11	50.0	45.1 - 55.0

Electron beam evaporated films of similar thicknesses are also available on 200 mesh copper grids; further details are available on request.

Ultra-thin carbon support film, 3 nm

Ultra-thin support films are carbon films with a removable Formvar® backing on the opposite side of the grid. The Formvar is then removed by dipping in solvent and the pure carbon film remains. These films are stable under all EM operating conditions and can be used where the presence of a Formvar layer is not acceptable. As thin pure carbon films alone have the tendency to be more delicate than those with a Formvar backing support they require more delicate handling during specimen preparation. Leaving the Formvar in place until sample preparation is complete ensures the carbon film remains intact.

These carbon films are available on copper or gold grids.

- S186H4** Ultra-thin support film on 400 mesh copper grid. Pack of 25
- S186-4** Ultra-thin support film on 400 mesh copper grid. Pack of 50
- S186A4** Ultra-thin support film on 400 mesh gold grid. Pack of 50

Also available are ultra-thin carbon films on a holey carbon support film. These are pure carbon films, with no Formvar backing, mounted on top of a supporting carbon holey film. The thickness of the carbon support film lying over the holes is less than 3 nm and is the thinnest carbon support film available. It is particularly useful for high resolution microscopy of low contrast particles and is also ideal for use with the Energy Filtering TEM.

- S187-4** Ultra-thin film on holey carbon support film, 400 mesh copper grid. Pack of 25

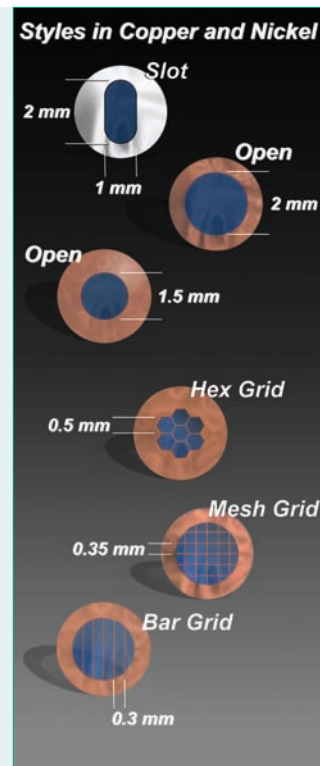
LUXFilm™ TEM supports

LUXFilm TEM supports are strong, thin films within a 3 mm grid that can span large open areas allowing the entire specimen to be viewed without interference from grid bars. The films have excellent beam stability and are robust even at cryogenic temperatures. They also exhibit minimal drift or charging effects. LUXFilms are approximately five times stronger than Formvar films and are compatible with a variety of common stains and ethanol based processing solutions. LUXFilms also show no sign of autofluorescence and no unspecific labelling with antibody stains. This makes them ideal for correlative microscopy and immunocytochemistry studies.

The support films are available in 30 nm and 50 nm thicknesses and with copper or nickel support frames. These films suit demanding TEM imaging of large or thick sections in the 80 - 300 kV range in tomography, pathology and immunocytochemistry applications.

The films are available in packs of 10.

Type	Copper	Nickel
30 nm film thickness		
LUXFilm TEM supports, 2 x 1 mm open area. Pack of 10	S1840-3	S1840N3
LUXFilm TEM supports, 1.5 mm dia open area. Pack of 10	S1841-3	S1841N3
LUXFilm TEM supports, 2.0 mm dia open area. Pack of 10	S1842-3	S1842N3
LUXFilm TEM supports, 0.5 mm hex grid. Pack of 10	S1843-3	S1843N3
LUXFilm TEM supports, 0.35 mm mesh grid. Pack of 10	S1844-3	S1844N3
LUXFilm TEM supports, 0.3 mm bar grid. Pack of 10	S1845-3	S1845N3
50 nm film thickness		
LUXFilm TEM supports, 2 x 1 mm open area. Pack of 10	S1840-5	S1840N5
LUXFilm TEM supports, 1.5 mm dia open area. Pack of 10	S1841-5	S1841N5
LUXFilm TEM supports, 2.0 mm dia open area. Pack of 10	S1842-5	S1842N5
LUXFilm TEM supports, 0.5 mm hex grid. Pack of 10	S1843-5	S1843N5
LUXFilm TEM supports, 0.35 mm mesh grid. Pack of 10	S1844-5	S1844N5
LUXFilm TEM supports, 0.3 mm bar grid. Pack of 10	S1845-5	S1845N5



Silicon monoxide films

Silicon monoxide support films are resilient and able to withstand vigorous specimen preparation techniques. They are excellent for high resolution work, have low background contrast and are stable under the electron beam. Furthermore they are less hydrophobic than carbon films. As with the ultra-thin carbon films, these silicon monoxide support films have a removable Formvar backing on the opposite side of the grid for additional initial stability.

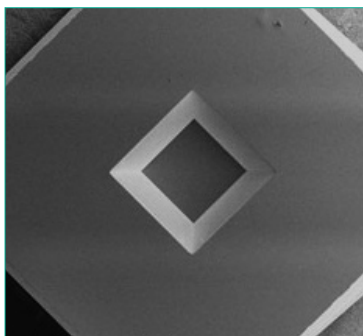
S169-13 Silicon monoxide on removable Formvar on 300 mesh copper grid. Pack of 50

S169-13H Silicon monoxide on removable Formvar on 300 mesh copper grid. Pack of 25

Silicon monoxide films are also available with a stabilised lacey Formvar film (this does not have a removable thin Formvar backing). These films are suitable for TEM applications involving the examination of biological and non-biological particle suspensions.

S185-3 Silicon monoxide on lacey Formvar on 300 mesh copper grid. Pack of 50

Silicon nitride membranes



Silicon nitride support membranes are suitable where carbon or plastic films are not appropriate. These silicon nitride membranes are extremely flat and smooth which significantly reduces the need for frequent re-focusing when scanning across large areas. The membranes have high stability under the electron beam, and are resistant to most chemicals with the exception of free fluorine. The mechanical stability of the membrane allows a range of microscopy techniques, such as TEM, SEM and AFM, to be used for a variety of nanotechnology experiments. Cells, fibres and particles etc. can be mounted directly onto the support film and examined.

They are available with different window sizes on a silicon support frame designed to fit a standard 3 mm TEM holder and in a range of thicknesses from 30 to 500 nm. The silicon nitride membranes are manufactured under clean room conditions and are chemically cleaned before packaging. Supplied as 10 support membranes in a grid box.

Type	Membrane thickness (nm)						
	30	50	75	100	150	200	500
200 µm substrate thickness							
Window size							
0.10 x 0.10 mm	S171-1T	S171-2T	S171-3T	S171-4T	S171-5T	S171-6T	S171-7T
0.25 x 0.25 mm	S171-1S	S171-2S	S171-3S	S171-4S	S171-5S	S171-6S	S171-7S
0.50 x 0.50 mm	S171-1	S171-2	S171-3	S171-4	S171-5	S171-6	S171-7
1.00 x 1.00 mm	S171-1L	S171-2L	S171-3L	S171-4L	S171-5L	S171-6L	S171-7L
1.00 x 0.25 mm	S171-1H	S171-2H	S171-3H	S171-4H	S171-5H	S171-6H	S171-7H
100 µm substrate thickness							
Window size							
0.10 x 0.10 mm	S172-1T	S172-2T	S172-3T	S172-4T	S172-5T	S172-6T	S172-7T
0.25 x 0.25 mm	S172-1S	S172-2S	S172-3S	S172-4S	S172-5S	S172-6S	S172-7S
0.50 x 0.50 mm	S172-1	S172-2	S172-3	S172-4	S172-5	S172-6	S172-7
1.00 x 1.00 mm	S172-1L	S172-2L	S172-3L	S172-4L	S172-5L	S172-6L	S172-7L
1.00 x 0.25 mm	S172-1H	S172-2H	S172-3H	S172-4H	S172-5H	S172-6H	S172-7H
200 µm substrate thickness							
Multi-frame array 1 (7 x 7 array)							
Window size							
0.50 x 0.50 mm	S171-1A7	S171-2A7	S171-3A7	S171-4A7	S171-5A7	S171-6A7	S171-7A7
200 µm substrate thickness							
Multi-frame array 2 (5 x 5 array)							
Window size							
0.50 x 0.50 mm	S171-1A5	S171-2A5	S171-3A5	S171-4A5	S171-5A5	S171-6A5	S171-7A5
200 µm substrate thickness							
Multi-frame array 3 (4 x 4 array)							
Window size							
0.50 x 0.50 mm	S171-1A4	S171-2A4	S171-3A4	S171-4A4	S171-5A4	S171-6A4	S171-7A4

Custom window sizes are available on request.

Silicon aperture frames

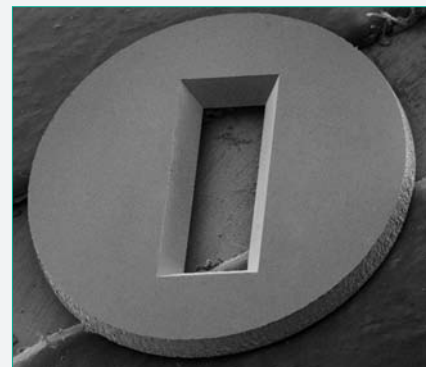
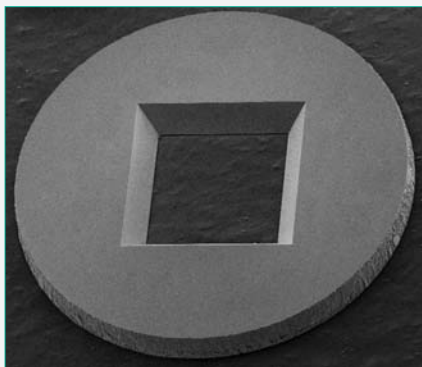
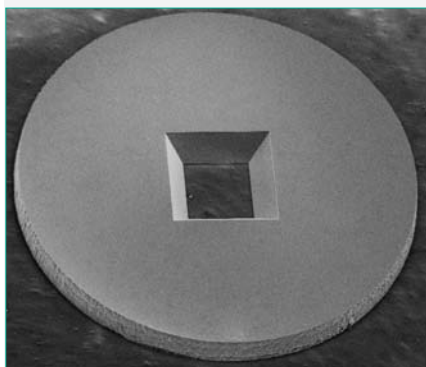
Silicon aperture frames are 3 mm diameter discs of thickness 200 µm containing square or rectangular apertures of three sizes. They are suitable for use as a support frame to attach TEM lamellae made with FIB instruments to allow for subsequent sample processing and TEM imaging. They are fully compatible with standard TEM holders. The aperture openings have a side window angle of 35.26° to allow for easy access.

Supplied as 10 frames in a grid box.

G3337-05 Silicon aperture frame, 0.5 x 0.5 mm. Pack of 10

G3337-10 Silicon aperture frame, 1.0 x 1.0 mm. Pack of 10

G3337-15 Silicon aperture frame, 0.5 x 1.5 mm. Pack of 10



Silicon nitride coated discs (blanks)

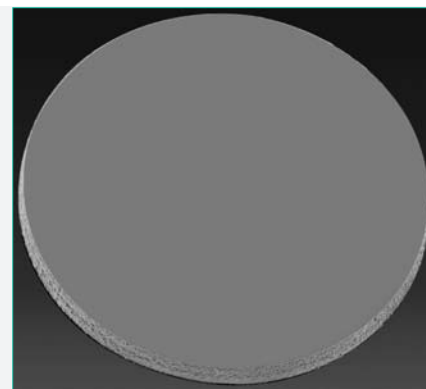
These 200 µm thick 3 mm silicon support discs have a low stress, ultra-flat 50 nm layer of silicon nitride on both sides. The film is non-stoichiometric and is closer to SiN than Si₃N₄. The discs are perfectly round with a specially designed edge for ease of handling. They also have no broken edges and are free of debris.

The discs have a mean surface roughness of 0.45 nm ± 0.2 nm. They can be used for a number of applications, including specimen mounts for SEM and FESEM applications and as specimen discs for AFM applications. Silicon nitride coated discs are also available with a hydrophilic surface coating which consists of a 5 nm atomic layer of hydroxylated aluminium deposited onto the membrane surface.

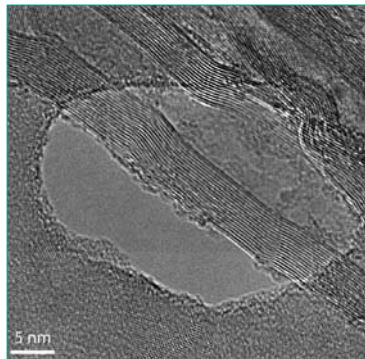
Supplied in packs of 10.

G3343 Silicon nitride discs, 3 mm dia. Pack of 10

G3343H Silicon nitride discs with hydrophilic coating, 3 mm dia. Pack of 10



TEM Windows silicon supports

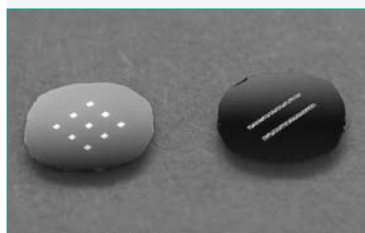


Multi-walled carbon nanotubes over a nanopore. Image provided by Brian McIntyre, University of Rochester

UltraSM® TEM Windows pure silicon support films are nanofabricated silicon membranes that are available as amorphous non-porous films, or as porous films with pores ranging from 10 - 50 nm in diameter. The 5, 9 or 15 µm thick non-porous support films are suitable for high resolution imaging, while the porous support films are ideal for background-free imaging. Robust silicon oxide supports of 20 nm and 40 nm thicknesses and silicon nitride supports of 50 nm thickness are also available. All types of films are resilient enough to withstand plasma cleaning.

The films are mounted on a 200 µm thick frame with either nine 100 x 100 µm squares or two 100 x 1500 µm slots.

Supplied in packs of 10.



- S1850-PSQ** UltraSM 15 nm porous silicon, square windows
- S1850-PSL** UltraSM 15 nm porous silicon, slot windows
- S1852-NSQ** UltraSM 5 nm porous silicon, square windows
- S1850-NSQ** UltraSM 15 nm non-porous silicon, square windows
- S1850-NSL** UltraSM 15 nm non-porous silicon, slot windows
- S1851-NSQ** UltraSM 9 nm non-porous silicon, square windows
- S1851-NSL** UltraSM 9 nm non-porous silicon, slot windows
- S1853-SQ** Silicon oxide 40 nm, square windows
- S1853-SL** Silicon oxide 40 nm, slot windows
- S1854-SQ** Silicon oxide 20 nm, square windows
- S1854-SL** Silicon oxide 20 nm, slot windows
- S1855-SQ** Silicon nitride 50 nm, square windows
- S1855-SL** Silicon nitride 50 nm, slot windows

Related products from TEM Windows:

Silicon frame

A silicon frame without a membrane. The 2.9 mm octagon frame is 200 µm thick with nine 100 x 100 µm squares.

- S1856** Silicon frame

Plastic handling tweezers

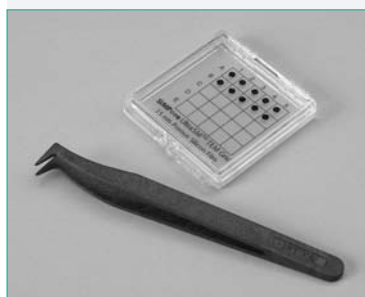
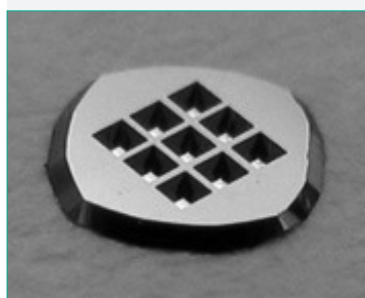
The square plastic tips handle the silicon frames gently.

- T5015** Plastic TEM Windows handling tweezers

Gel-Pak® storage box

With a 5 x 5 index offering easy identification of multiple samples.

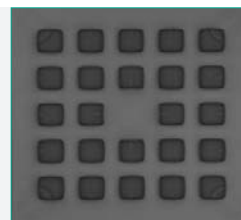
- G3969** Gel-Pak box 25 x 25 x 10 mm with 5 x 5 index



Silicon dioxide films

Silicon dioxide films offer a TEM support membrane of exceptional flatness combined with a thickness of 40 nm or 8 nm. The membrane window area (0.5 x 0.5 mm) is patterned into 24 apertures of 50 x 50 µm for the 40 nm films and 60 x 60 µm for the 8 nm films. The bar size between the SiO₂ apertures is 30 µm and the boundary width is 65 µm. The silicon dioxide films are supported on a 200 µm silicon support structure which fits into all standard TEM holders. Silicon dioxide support films have excellent chemical, physical and thermal stability. They can be used for nanomaterial deposition and growth, thin film analysis and characterisation, catalyst research and development, supporting FIB lamellae, characterisation of semiconductor materials and imaging of biological materials.

- S167** Silicon dioxide support film, 40 nm, 50 x 50 µm. Pack of 10
S167T Silicon dioxide support film, 8 nm, 50 x 50 µm. Pack of 10



Silicon wafers

Silicon wafers polished on one side:

These silicon wafers of 2" (50.8 mm), 3" (76.2 mm) and 4" (102 mm) diameter can be used either as substrates for thin film research or to make small silicon substrates by dicing the wafer into smaller pieces using a scribe. Wafers generally have flats or notches cut into one or more sides indicating the crystallographic plane and doping type. These silicon wafers are available as either P-type (boron doped) wafers which are cut with a primary flat or N-type (phosphor doped) wafers that are cut with an additional secondary flat (cut 45° to the primary flat). The crystallographic orientation is (111). The wafers are 460 - 530 µm thick, polished on one side and do not have a silicon dioxide top coating.

Each wafer is shipped in a wafer carrier.

- G3336-2** Silicon wafer, 2" (50.8 mm)
G3336-3 Silicon wafer, 3" (76.2 mm)
G3336-4 Silicon wafer, 4" (102 mm)

Silicon wafers polished on both sides:

There is a wide range of silicon wafers available for thin film deposition and instrument calibration, with diameters ranging from 1" (25.4 mm) to 6" (152 mm). These wafers are available polished on both sides and can be subdivided if required into smaller pieces to make silicon substrates. They can be supplied as both N-type and P-type silicon, and with orientations of (100), (110) and (111).

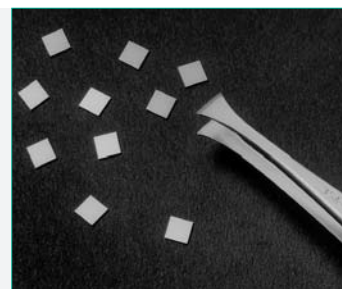
Further details are available on request.



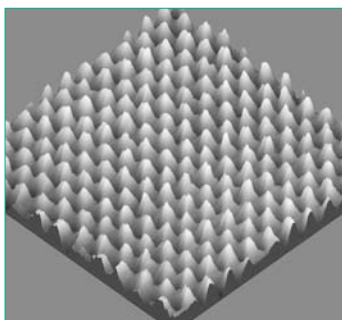
Super-smooth silicon mounts

Polished silicon chips are ideal mounts for examining the fine structure of small particles where the interference from the structure of machined aluminium or carbon stubs is a problem. The silicon chips can be attached to any type of specimen stub. They are opaque, of low electrical resistance and have surface properties equal to glass. Their chemical inertness makes them good substrates for growing or mounting cells for SEM studies. The chips have been cleaned before packaging and are supplied as a 4" (102 mm) wafer, pre-cut into 5 x 7 mm or 5 x 5 mm chips that can be easily separated in the laboratory. The surface finish roughness is less than 1 nm, the crystallographic orientation is (111) and they are available both as P-type (boron) or N-type (phosphor) wafers. The wafer thickness is 460 - 530 µm, polished on one side and without a silicon dioxide top coating.

- G3390** Silicon wafer, chips 5 x 5 mm. Approx 270 chips per wafer
G3391 Silicon wafer, chips 5 x 7 mm. Approx 187 chips per wafer



Highly ordered pyrolytic graphite (HOPG)



HOPG is widely used as a substrate for specimens to be examined in scanning probe microscopy. It is also used as a calibration specimen and cleaves almost like mica because of its layered structure. Unlike mica, HOPG is non-polar and, for samples where elemental analysis is required, it provides a carbon-only background. It consists of highly ordered planes of carbon atoms in (002) orientation and the quality of these parallel planes is defined by the mosaic spread angle.

The standard grade of HOPG has a mosaic angle of $3.5^\circ \pm 1.5^\circ$, while substrates with more highly ordered planes, with mosaic angles of $0.8^\circ \pm 0.2^\circ$ and $0.4^\circ \pm 0.1^\circ$, are also available.

G3389	HOPG mosaic spread $3.5^\circ \pm 1.5^\circ$, 10 x 10 x 2 mm
G3389-1212	HOPG mosaic spread $3.5^\circ \pm 1.5^\circ$, 12 x 12 x 2 mm
G3389-1717	HOPG mosaic spread $3.5^\circ \pm 1.5^\circ$, 17 x 17 x 2 mm
G3046-55	HOPG mosaic spread $0.8^\circ \pm 0.2^\circ$, 5 x 5 x 1 mm
G3046-1010	HOPG mosaic spread $0.8^\circ \pm 0.2^\circ$, 10 x 10 x 1 mm
G3045-55	HOPG mosaic spread $0.4^\circ \pm 0.1^\circ$, 5 x 5 x 1 mm
G3045-1010	HOPG mosaic spread $0.4^\circ \pm 0.1^\circ$, 10 x 10 x 1 mm

Other sizes are available on request.

Gold-coated substrates

PLATYPUS™ gold-coated substrates are deposited using an electron beam evaporator in a dedicated clean environment which permits precise control of gold deposition rates and also surface roughness. A titanium adhesion layer on the plasma-cleaned surfaces is used to prevent contamination of the gold film. Substrates of mica, silicon, aluminosilicate glass slides and coverslips are available, with a range of thicknesses of gold film. The gold-coated mica and aluminosilicate glass slides can be flame-annealed for atomically flat terraces and enhanced (111) orientation. They can be used in many surface science fields, including cell culture, SPM calibration, electrochemistry, biosensors and nano-wetting experiments.



F7041

Mica

F7040	38 x 26 mm with 200 nm gold
F7041	76 x 26 mm with 200 nm gold

Silicon wafers

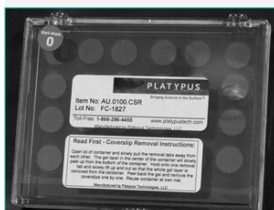
F7042	4" dia (525 μ m thick) with 100 nm gold. Pack of 3
F7043	4" dia (525 μ m thick) with 100 nm gold. Pack of 12



F7044

Aluminosilicate glass slides

F7044	76 x 26 mm (0.7 mm thick) with 10 nm gold. Pack of 5
F7045	76 x 26 mm (0.7 mm thick) with 50 nm gold. Pack of 5
F7046	76 x 26 mm (0.7 mm thick) with 100 nm gold. Pack of 5



F7047/8/9

Coverslips

F7047	22 mm square (0.13 - 0.16 mm thick) with 10 nm gold. Pack of 12
F7048	22 mm square (0.13 - 0.16 mm thick) with 50 nm gold. Pack of 12
F7049	15 mm dia circular (0.13 - 0.16 mm thick) with 10 nm gold. Pack of 24

Arrandee™ gold-coated substrates

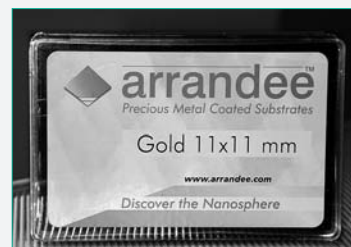
Arrandee gold-coated substrates use a borosilicate glass base of 0.7 mm thickness. They are suitable for easy preparation of gold terraces and by simple flame annealing 100 x 100 nm Au (111) terraces can easily be obtained.

A thin layer of chromium, 1 - 4 nm, is applied to the glass surface. This layer guarantees optimum adhesion to the glass as well as to the subsequently deposited gold layer (250 nm ± 50 nm). Arrandee substrates are very useful for SPM investigations.

F7037-25 Gold-coated substrates 11 x 11 mm. Pack of 25

F7037 Gold-coated substrates 11 x 11 mm. Pack of 50

F7038 Gold-coated substrates 12 x 12 mm. Pack of 50

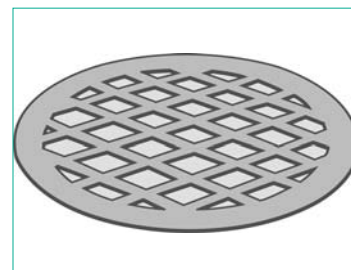


Substratek™ metallic TEM substrates

Substratek metallic TEM substrates are innovative, electron transparent, ultra-thin substrates that are ideal for diverse applications, allowing TEM examination without the need for time consuming and expensive specimen preparation. Compared to the widely used carbon support films, ultra-thin metallic films have a high surface energy and are therefore more suitable for fabrication processes.

Applications include electrochemistry, nanofabrication, micro-contact printing, nano-crystal growth and X-ray analysis of materials containing carbon. Gold, platinum and palladium substrates of 2 - 3 nm thickness and TiOx substrates of 10 - 20 nm thickness are available on 300 and 400 mesh TEM grids. The gold, platinum and palladium substrates are deposited on gold TEM grids that are compatible with electrochemical processes. The TiOx substrate is a bio-compatible material suitable for life science applications and is deposited on copper TEM grids.

They are supplied in a grid box.



Type	300 mesh	400 mesh
Substratek, 2 - 3 nm platinum on gold. Box of 10	S178-3P1	S178-4P1
Substratek, 2 - 3 nm platinum on gold. Box of 25	S178-3P2	S178-4P2
Substratek, 2 - 3 nm gold on gold. Box of 10	S178-3A1	S178-4A1
Substratek, 2 - 3 nm gold on gold. Box of 25	S178-3A2	S178-4A2
Substratek, 2 - 3 nm palladium on gold. Box of 10	S178-3PD1	S178-4PD1
Substratek, 2 - 3 nm palladium on gold. Box of 25	S178-3PD2	S178-4PD2
Substratek, 10 - 20 nm TiOx on copper. Box of 10	S178-3T1	S178-4T1
Substratek, 10 - 20 nm TiOx on copper. Box of 25	S178-3T2	S178-4T2

