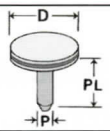
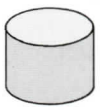
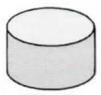
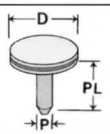
SEM Calibration Mounts

Selecting the Specimen Mount for SEM Test Specimens. Listed below are several standard specimen mount types and adapters for the SEM. Specific electron microscope information by manufacturer listed on our web page.

Specimen Mount Guide			
Type	**Prod. No.**	**picture**	**Data:** D=Head Dia. P=Pin Dia. PL=Pin Length
A	16111		D=12.7mm P=3.2mm PL=7.9mm
B	16261		D=12.7mm P=3.2mm PL=14.3mm
C	16221		9.5ø x 9.5mm cylinder
D	16281		15ø x 15mm cylinder
E	16291		15ø x10mm cylinder
F	16111-9		D=12.7mm P=3.2mm PL=6mm
G	**You Supply the Mount**		
K	16324		D=15mm
L	16327		D=25mm
M	16231		12.2 x 10mm
O	16115		31.7ø x 6.47mm
P	16242		D=12.7mm x 10mm AMRAY special slotted head

Note: See page 537 for complete listings of SEM Mount Storage Boxes.

Sample Storage Boxes

■ PELCO® 18 SEM Pin Mount Storage Holder and Box

Versatile, cost effective SEM pin mount storage box and holder for pin stubs with a 3.2mm (⅛") pin. Numbered 1-18 with the spacing designed to accommodate all types of pin mounts with a diameter from 6.4 to 50mm. Can hold 18 of 12.7mm pin mounts, 8 of 25mm pin mounts, 2 of 32, 38 or 50mm pin mounts with space left for the smaller pin mounts.

16709 SEM Storage Box and holder for up to 18 of 12.7mm pin mounts . . . .each

■ Plastic Box with Holder for JEOL 9.5mm SEM Cylinder Mounts

The 16700 "Standard" plastic box with 16135 holder. For ⅜" (9.5mm) diameter JEOL cylinder mounts.

16130 Plastic Box, Standard, with Cylinder Mount Holder, 9.5mm dia. . . . . .each

■ Universal Mount Holder with Tall Storage Box

Universal (two sided) Mount Holder 16166 with removable stand-off pin that keeps the holder in place if box is tipped or inverted in Storage Box 16708.

Holds 12 each ⅛" (3.2mm) dia. pin stubs, or 12 each ⅜" (9.5mm) dia. or 15mm dia. cylinder mounts.

16160 Universal Mount Holder and Tall Storage Box . . . .each

■ Plastic Box with SEM Pin Mount Holder

The 16700 "Standard" plastic box with 16125 pin stub holder. For ½" (12.7mm) diameter SEM pin mounts with ⅛" (3.2mm) pin diameter. Used for FEI/Philips, ZEISS/LEO/Leica, Cambridge, CamScan, Tescan, Amray and Etec SEMs.

16120 Plastic Box, Standard, with Pin Mount Holder . . . . . .each

■ SEM 12.7mm (½"), 25mm (1") Grooved Head Pin Grippers

Stainless steel gripper tweezers specially made for handling and transporting grooved SEM pin mounts. Sizes available are 12.7, 25 and 32mm (½", 1" and 1-¼") used in FEI/Philips, Zeiss/LEO, Leica, AMRAY, Cambridge Instruments, Camscan and Tescan SEMs.

30° Angle SEM Pin Mount Gripper

Non-Magnetic, tweezer style SEM Mount Gripper for holding standard 12.7mm Grooved Pin Mounts.

Conveniently grasp the grooved head of a scanning electron microscopy pin mount.

1664 SEM Pin Mount Gripper, NM, 30° angle, for 12.7mm pin stubs . . . . . .each

PELCO® 45° Angle, SEM Pin Mount Gripper

Non-magnetic, tweezer style SEM Mount Gripper for handling grooved pin mounts. Conveniently grasp the grooved head of SEM pin mounts with 12.7mm diameter. 45° angle, 114mm long.

1663-12 PELCO® SEM Pin Mount Gripper, NM, 45° angle, for 12.7mm pin stubs . . . . .each

PELCO® 57° Angle SEM Pin Mount Gripper

Tweezer Style, holds pin mounts, 12.7mm dia. with grooved edge. Stainless steel, 57° angle, 100mm long.

1667 PELCO® Tweezer Style Pin Mount Gripper NM, 57° angle, for 12.7mm pin stubs . . . . . .each

■ PELCO® 45° Angle SEM 25mm (1") Grooved Head Pin Mount Gripper

SEM Pin Mount Gripper for 25mm pin stubs, 45° angle, 154mm long.

1663-25 PELCO® SEM Pin Mount Gripper for 25mm pin stubs . . . . . .each

■ PELCO® SEM 32mm (1.25") Grooved Head Pin Mount Gripper

Tweezer Style Mount Gripper for Grooved 32mm (1.25") dia. pin mounts, 45° angle, 154mm long.

1663-32 PELCO® SEM Pin Mount Gripper for 32mm pin stubs . . . . . .each

■ PELCO® SEM Cylinder Mount Grippers

Stainless steel, tweezer style grippers with a convenient angle for easy handling and transporting of many types of SEM cylinder mounts. Size ranges from 10-32mm dia., for JEOL, Hitachi, and ISI/ABT/Topcon mounts.

PELCO® Cylinder Mount Gripper for 10mm dia.

1665 PELCO® Cylinder Mount Gripper, for 10mm dia., 130mm L . . . . . .each

PELCO® Cylinder Mount Gripper for 12.5mm dia.

1659-12 PELCO® Cylinder Mount Gripper, for 12.5mm dia., 149mm L . . . . . .each

PELCO® Cylinder Mount Gripper for 15mm dia.

1666 PELCO® Cylinder Mount Gripper, for 15mm dia., 140mm L . . . . . .each

PELCO® Cylinder Mount Grippers for 25mm dia.

1659-25 PELCO® Cylinder Mount Gripper, for 25mm dia., 153mm L . . . . . .each

PELCO® Cylinder Mount Grippers for 32mm dia.

1659-32 PELCO® Cylinder Mount Gripper, for 32mm dia., 154mm L . . . . . .each

■ Atomic Force Microscopy Gold Calibration Kit

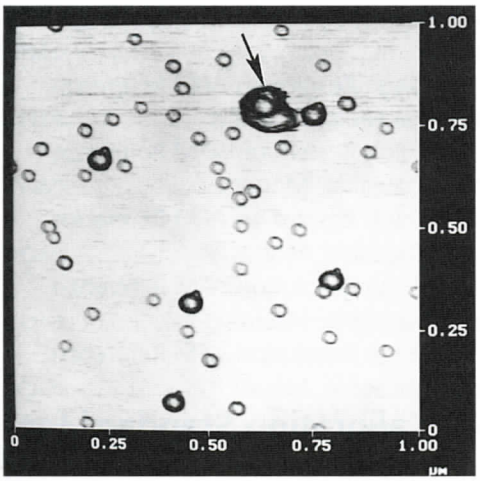


Fig. 1. AFM scan of 7.7, 14.6 and 28.4nm gold particles.

Note: Scan (arrow) of 28.4nm particle indicates the presence of a tip artifact.

Characterized colloidal gold particles for:

- **Characterization of scanning tip geometry**
- **Reliable calibration of the vertical scale of piezoelectric response**
- **Characterizing vertical dimensions of coadsorbed biomolecules**

Three sizes of colloidal gold particles are available in a convenient kit form. The kit contains 8 numbered 15mm AFM discs with mica attached for calibration and tip characterization. Remaining colloidal gold can be used for coadsorption with biomolecules or other samples.

16200 and 16205 Kits Contain:

- PELCO® 15mm AFM Disc Carrier
- 15mm AFM Discs, numbered with 9.9mm Mica Discs attached, 8 ea., in 16214 PELCO® AFM Disc Carrier
- PELCO® AFM Disc Pickup Tool
- Gold Colloid, 5nm Range, 500µl
- Gold Colloid, 15nm Range, 500µl
- Gold Colloid, 30nm Range, 500µl
- Poly-L-Lysine, 0.1%, 500µl
- Protocol & Reprint (see below)

16200 PELCO® AFM Gold Standard Kit . . . . . .each

16205 Same as above plus 2 additional gold sizes, 10 & 20nm Range . . . . . .each

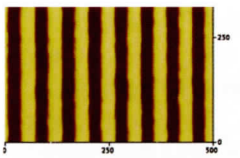
Vesenka J, Manne S, Giberson R, Marsh T and Henderson E, 1993. Colloidal Gold Particles as an Incompressible Atomic Force Microscope Imaging Standard for Assessing the Compressibility of Biomolecules. Biophysical Journal 65:1-6.

See abstract on web page: tedpella.com/Calibrat_html/16200.htm

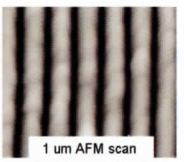
High Magnification, High Resolution Reference and Calibration Standards for AFM, SEM, Auger and FIB

Holographic Grating for Scanning Electron Microscopy, Atomic Force Microscopy, Auger and Focused Ion Beam

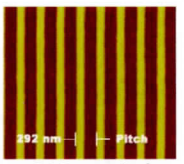
Precision, holographic patterns, provide accurate calibration and feature high stability and usability. Moderate ridge heights are convenient for AFM. Specimens provide good contrast for secondary and backscatter imaging with SEM. They enable accurate calibration for high resolution, nanometer-scale measurements. Available with 70, 145 and 292nm pitch.



70nm pitch



145nm pitch



292nm pitch

■ 70nm Pitch Reference Standard for Very High Resolution Calibration for AFM, SEM, Auger and FIB.

Period: 70nm pitch nominal, one dimensional array. Accuracy is +/- 0.25nm. Calibration certificate will give the actual pitch of the standard.

Surface structure: Silicon Dioxide ridges on Silicon, 4x3mm dimensions. Ridge height and width are both about 35nm (not calibrated).

Usability: The calibrated pattern covers a 1.2 x 0.5mm area. There is sufficient usable area to make thousands of measurements without reusing any areas contaminated or altered by previous scans.

AFM: Use in contact, tapping and other modes with image sizes from 100nm to 3um. Mounted on a 12mm steel AFM disk.

SEM, Auger, FIB: Can be used for a wide range of accelerating voltage (1kV-20kV) and calibrates images from 25kX to 1000kX. Can be supplied unmounted or mounted on an SEM stub of your choice.

Certification: There is a version with a non-traceable manufacturer's certificate stating average pitch, based on batch measurements.

There is also the traceable, certified version measured in comparison with a standard calibrated at PTB (Physiklisch-Technische Bundesanstalt in Braunschweig, Germany, the German counterpart of NIST). The standard is NIST traceable by virtue of the mutual recognition agreement by NIST and PTB.

70nm AFM Reference Standard, Certified, Non-traceable, Mounted on disk:

641-1AFM 70nm Very High Resolution AFM Reference Standard on 12mm steel disk . . . . . .each

70nm SEM, Auger and FIB Reference Standard, Certified, Non-traceable, Unmounted

641-1 70nm Very High Resolution AFM Reference Standard, Unmounted . . . . . .each

continued on next page

■ 70nm SEM, Auger and FIB Reference Standard, Certified, Non-traceable, on specific mount

(mount description A - P on page 31)

641-1A 70nm Very High Resolution AFM Reference Standard, Mount A . . . . . .each
641-1B 70nm Very High Resolution AFM Reference Standard, Mount B . . . . . .each
641-1C 70nm Very High Resolution AFM Reference Standard, Mount C . . . . . .each
641-1D 70nm Very High Resolution AFM Reference Standard, Mount D . . . . . .each
641-1E 70nm Very High Resolution AFM Reference Standard, Mount E . . . . . .each
641-1F 70nm Very High Resolution AFM Reference Standard, Mount F . . . . . .each
641-1G 70nm Very High Resolution AFM Reference Standard, Mount G, you supply mount . .each
641-1K 70nm Very High Resolution AFM Reference Standard, Mount K . . . . . .each
641-1L 70nm Very High Resolution AFM Reference Standard, Mount L . . . . . .each
641-1M 70nm Very High Resolution AFM Reference Standard, Mount M . . . . . .each
641-1O 70nm Very High Resolution AFM Reference Standard, Mount O . . . . . .each
641-1P 70nm Very High Resolution AFM Reference Standard, Mount P . . . . . .each

70nm SEM, Auger and FIB Reference Standard, Certified, Traceable, Mounted on disk

641-11AFM 70nm Very High Resolution AFM Reference Standard, Traceable, on 12mm steel disk each

70nm SEM, Auger and FIB Reference Standard, Certified, Traceable, Unmounted

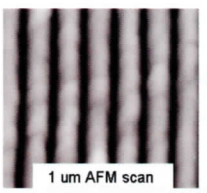
641-11 70nm Very High Resolution AFM Reference Standard, Traceable, Unmounted . . . . .each

70nm SEM, Auger and FIB Reference Standard, Certified, Traceable, on specific mount

(mount description A - P on page 31)

641-11A 70nm Very High Resolution AFM Reference Standard, Traceable, Mount A . . . . . .each
641-11B 70nm Very High Resolution AFM Reference Standard, Traceable, Mount B . . . . . .each
641-11C 70nm Very High Resolution AFM Reference Standard, Traceable, Mount C . . . . . .each
641-11D 70nm Very High Resolution AFM Reference Standard, Traceable, Mount D . . . . . .each
641-11E 70nm Very High Resolution AFM Reference Standard, Traceable, Mount E . . . . . .each
641-11F 70nm Very High Resolution AFM Reference Standard, Traceable, Mount F . . . . . .each
641-11G 70nm Very High Resolution AFM Reference Standard, Traceable, Mount G, you supply mount . . . . . .each
641-11K 70nm Very High Resolution AFM Reference Standard, Traceable, Mount K . . . . . .each
641-11L 70nm Very High Resolution AFM Reference Standard, Traceable, Mount L . . . . . .each
641-11M 70nm Very High Resolution AFM Reference Standard, Traceable, Mount M . . . . . .each
641-11O 70nm Very High Resolution AFM Reference Standard, Traceable, Mount O . . . . . .each
641-11P 70nm Very High Resolution AFM Reference Standard, Traceable, Mount P . . . . . .each

■ 145nm Pitch Calibration Standard for AFM



145nm pitch

Precision holographic pattern for accurate calibration for high resolution, nanometer scale measurements.

Period: 145nm pitch nominal, one dimensional array. Accuracy is +/- 1nm. Calibration certificate will give the actual pitch of the standard.

Surface structure: Aluminum lines on glass, 4x6mm dimensions. Line height (about 100nm) and line width (about 75nm) are not calibrated.

Usability: The calibrated pattern covers the entire standard. There is sufficient usable area to make tens of thousands of measurements without reusing any areas contaminated or altered by previous scans.

AFM: Use in contact, tapping and other modes with image sizes from 250nm to 10µm. Available unmounted or mounted on a 12mm steel AFM disk.

Certification: Comes with a non-traceable manufacturer's certificate stating average pitch, based on batch measurements.

145nm AFM Reference Standard, Certified, Non-traceable, Mounted on disk

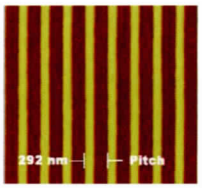
642-1AFM 145nm Very High Resolution AFM Reference Standard on 12mm steel disk . . . . . .each

145nm AFM Reference Standard, Certified, Non-traceable, Unmounted

642-1 145nm Very High Resolution AFM Reference Standard, Unmounted . . . . . .each

High Magnification, High resolution Reference and Calibration Standards for AFM, SEM, Auger and FIB continued on next page

■ 292nm Pitch High Magnification, High Resolution Calibration Standard for AFM, SEM, Auger and FIB



292nm pitch

A precision holographic grating standard with high contrast and excellent edge definition.

Period: 292nm pitch nominal, one dimensional array. Accuracy is +/- 1%. Calibration certificate will give the actual pitch of the standard.

Surface structure: Titanium lines on Silicon, 4x3mm dimensions. Line height (about 30nm) and line width (130nm) are not calibrated.

Usability: The calibrated pattern covers the entire chip. There is sufficient usable area to make tens of thousands of measurements without reusing any areas contaminated or altered by previous scans.

AFM: Use in contact, tapping and other modes with image sizes from 500nm to 20µm. Mounted on a 12mm steel AFM disk.

SEM, Auger, FIB: Can be used for a wide range of accelerating voltages (<1kV-30kV) and calibrates images from 5kX to 200kX. Can be supplied unmounted or mounted on an SEM stub of your choice.

Certification: There is a version with a non-traceable manufacturer's certificate stating average pitch, based on batch measurements.

There is also the traceable, certified version measured in comparison with a standard calibrated at PTB (Physikalisch-Technischen Bundesanstalt in Braunschweig, Germany, the German counterpart of NIST). The standard is NIST traceable by virtue of the mutual recognition agreement by NIST and PTB.

292nm AFM Reference Standard, Certified, Non-traceable, Mounted on disk

643-1AFM 292nm High Resolution AFM Reference Standard on 12mm steel disk . . . . . .each

292nm SEM, Auger and FIB Reference Standard, Certified, Non-traceable, Unmounted

643-1 292nm High Resolution AFM Reference Standard, Unmounted . . . . . .each

292nm SEM, Auger and FIB Reference Standard, Certified, Non-traceable, on specific mount
(mount description A - P on page 31)

643-1A 292nm High Resolution AFM Reference Standard, Mount A . . . . . .each
643-1B 292nm High Resolution AFM Reference Standard, Mount B . . . . . .each
643-1C 292nm High Resolution AFM Reference Standard, Mount C . . . . . .each
643-1D 292nm High Resolution AFM Reference Standard, Mount D . . . . . .each
643-1E 292nm High Resolution AFM Reference Standard, Mount E . . . . . .each
643-1F 292nm High Resolution AFM Reference Standard, Mount F . . . . . .each
643-1G 292nm High Resolution AFM Reference Standard, Mount G, you supply mount . . . .each
643-1K 292nm High Resolution AFM Reference Standard, Mount K . . . . . .each
643-1L 292nm High Resolution AFM Reference Standard, Mount L . . . . . .each
643-1M 292nm High Resolution AFM Reference Standard, Mount M . . . . . .each
643-1O 292nm High Resolution AFM Reference Standard, Mount O . . . . . .each
643-1P 292nm High Resolution AFM Reference Standard, Mount P . . . . . .each

292nm AFM Reference Standard, Certified, Traceable, Mounted on disk

643-11AFM 292nm High Resolution AFM Reference Standard on 12mm steel disk . . . . . .each

292nm SEM, Auger and FIB Reference Standard, Certified, Traceable, Unmounted

643-11 292nm High Resolution AFM Reference Standard, Traceable, Unmounted . . . . . .each

292nm SEM, Auger and FIB Reference Standard, Certified, Traceable, on specific mount
(mount description A - P on page 31)

643-11A 292nm High Resolution AFM Reference Standard, Traceable, Mount A . . . . . .each
643-11B 292nm High Resolution AFM Reference Standard, Traceable, Mount B . . . . . .each
643-11C 292nm High Resolution AFM Reference Standard, Traceable, Mount C . . . . . .each
643-11D 292nm High Resolution AFM Reference Standard, Traceable, Mount D . . . . . .each
643-11E 292nm High Resolution AFM Reference Standard, Traceable, Mount E . . . . . .each
643-11F 292nm High Resolution AFM Reference Standard, Traceable, Mount F . . . . . .each
643-11G 292nm High Resolution AFM Reference Standard, Traceable, Mount G, you supply mount . . . . . .each
643-11K 292nm High Resolution AFM Reference Standard, Traceable, Mount K . . . . . .each
643-11L 292nm High Resolution AFM Reference Standard, Traceable, Mount L . . . . . .each
643-11M 292nm High Resolution AFM Reference Standard, Traceable, Mount M . . . . . .each
643-11O 292nm High Resolution AFM Reference Standard, Traceable, Mount O . . . . . .each
643-11P 292nm High Resolution AFM Reference Standard, Traceable, Mount P . . . . . .each

2D Holographic Array Standards

Very High Resolution 2D Calibration Standard for AFM, STM, Auger, FIB, and SEM

Period: 144nm pitch, two-dimensional array. Accurate to ±1nm. Refer to calibration certificate for actual pitch.

Surface: Aluminum bumps on Silicon, 4x3mm die. Bump height (about 90nm) and width (about 75nm) are not calibrated.

Usability: The calibrated pattern covers the entire chip. There is sufficient usable area to make tens of thousands of measurements without reusing any areas altered or contaminated by previous scans.

AFM: Use in contact, intermittent contact (TappingMode™) and other modes with image sizes from 250nm to 10mm. Available unmounted or mounted on 12mm steel disks.

SEM: This specimen works well at all accelerating voltages. Normally supplied unmounted. Can be mounted on a stub of your choice.

Model 2D: This Calibration Reference specimen comes with a non-traceable manufacturer's certificate. This states the average period, based on batch measurements.

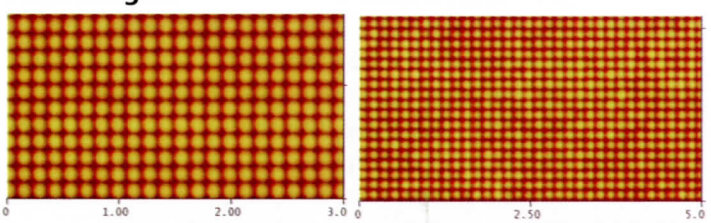
Model 2DUTC: This Traceable, Certified Standard is a select grade. Each standard is individually measured in comparison with a similar specimen calibrated at PTB. (PTB, Physikalisch-Technische Bundesanstalt, is the German counterpart of NIST.) The uncertainty of single pitch values is typically ±1.4nm (95% confidence interval). Multi-pitch measurements provide the usual square-root of N improvement in precision.

Easy to use

The 2D holographic Array with 144nm is recommended because of the unique characteristics that make it especially easy to use. The pattern is durable and allows for scanning in contact mode, which means that calibration and measurements are faster. This is the only high resolution 2D calibration standard we know of that has all of the following characteristics that are needed for ease of use:

- 2-dimensional array for simultaneous calibration of X and Y axes
- Pitch < 500nm
- Array of bumps means the image contrast is high even when the probe tip is slightly dull
- High contrast in contact mode scans
- Pattern covers the entire die, no need to hunt for the scan area.

AFM images:



Tapping Mode 3µm AFM scan *Contact Mode 5µm AFM scan*

During scanning in contact mode using a 0.5 N/m SiN cantilever, no surface or tip wear affecting the image was noticed.

Further information available on our web site:
www.tedpella.com/Calibrat_html/16465-2D.htm

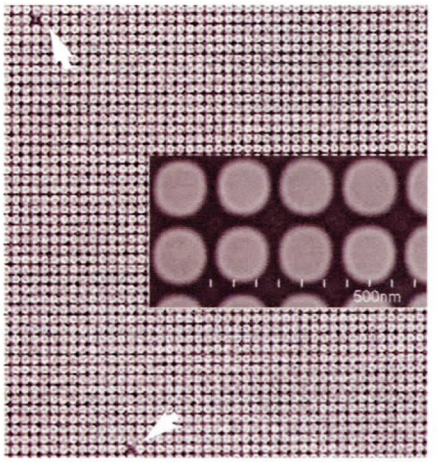
SEM Images

High Magnification

The following image (inset) was captured with a magnification setting of 100 kX and accelerating voltage 10 kV. Outside Image 20 kV.

Medium Magnification

At 5 kX, the individual bumps were still well-resolved. Large fields of view show how few defects are present. The most common defects are single missing bumps or a single extra bump inserted between lattice positions. Two vacancies are present in the image shown here.



SEM Reference Standards, Certified, Non-Traceable Unmounted or Mounted

(mount description A - P on page 31)

16465-2D 2D Pattern Calibration Standard, unmounted . . . . . .each

16465-2D-A 2D-A Pattern Calibration Standard, on Mount A . . . . . .each

16465-2D-B 2D-B Pattern Calibration Standard, on Mount B . . . . . .each

16465-2D-C 2D-C Pattern Calibration Standard, on Mount C . . . . . .each

16465-2D-D 2D-D Pattern Calibration Standard, on Mount D . . . . . .each

16465-2D-E 2D-E Pattern Calibration Standard, on Mount E . . . . . .each

16465-2D-F 2D-F Pattern Calibration Standard, on Mount F . . . . . .each

16465-2D-G 2D-G Pattern Calibration Standard, on Mount G, you supply mount . . . . . .each

16465-2D-K 2D-K Pattern Calibration Standard, on Mount K . . . . . .each

16465-2D-L 2D-L Pattern Calibration Standard, on Mount L . . . . . .each

16465-2D-M 2D-M Pattern Calibration Standard, on Mount M . . . . . .each

16465-2D-O 2D-O Pattern Calibration Standard, on Mount O . . . . . .each

16465-2D-P 2D-P Pattern Calibration Standard, on Mount P . . . . . .each

continued on next page

2D Holographic Array Standards

continued

AFM Reference Standard, Certified, Non-Traceable Mounted on Disk

16465-2D-AFM 2D Pattern Calibration Standard, on 12mm steel disk . . . . . .each

SEM Reference Standards, Certified Traceable, Calibration Certificate Provided, Unmounted and Mounted (mount description A - P on page 31)

16465-2DUTC 2DUTC Pattern Calibration Standard, unmounted, with certificate . . . . . .each

16465-2DUTC-A 2DUTC Pattern Calibration Standard, on Mount A, with certificate . . . . .each

16465-2DUTC-B 2DUTC Pattern Calibration Standard, on Mount B, with certificate . . . . .each

16465-2DUTC-C 2DUTC Pattern Calibration Standard, on Mount C, with certificate . . . . .each

16465-2DUTC-D 2DUTC Pattern Calibration Standard, on Mount D, with certificate . . . . .each

16465-2DUTC-E 2DUTC Pattern Calibration Standard, on Mount E, with certificate . . . . .each

16465-2DUTC-F 2DUTC Pattern Calibration Standard, on Mount F, with certificate . . . . . .each

16465-2DUTC-G 2DUTC Pattern Calibration Standard, on Mount G, you supply mount . . .each

16465-2DUTC-K 2DUTC Pattern Calibration Standard, on Mount K, with certificate . . . . .each

16465-2DUTC-L 2DUTC Pattern Calibration Standard, on Mount L, with certificate . . . . .each

16465-2DUTC-M 2DUTC Pattern Calibration Standard, on Mount M, with certificate . . . . .each

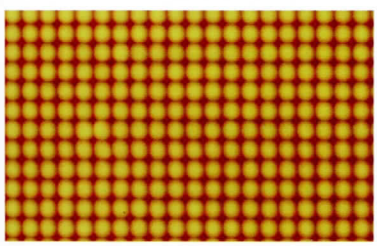
16465-2DUTC-O 2DUTC Pattern Calibration Standard, on Mount O, with certificate . . . . .each

16465-2DUTC-P 2DUTC Pattern Calibration Standard, on Mount P, with certificate . . . . . .each

AFM Reference Standard, Certified Traceable, Calibration Certificate Provided, Mounted on Disk

16465-2DUTC-AFM 2DUTC-AFM Pattern Calibration Standard, on 12mm steel disk, with certificate . . . . . .each

300nm Pitch High Resolution 2D Calibration Standard for AFM, STEM, SEM, Auger and FIB.



Period: 300nm pitch nominal, one dimensional array. Calibration certificate will give the actual pitch of the standard.

Surface Structure: Aluminum bumps on Silicon, 4 x 3mm die: Bump height (about 50nm) and width (about 150nm) not calibrated.

Usability: The calibrated pattern covers the entire chip. There is sufficient usable area to make thousands of measurements without reusing any areas contaminated or altered by previous scans.

AFM: Use in contact, tapping and other modes with image sizes from 500nm to 20nm. Mounted on a 12mm steel AFM disk.

SEM: Auger, FIB: Can be used for a wide range of accelerating voltage (1kV-20kV) and calibrates images from 5kX to 200kX. Can be supplied unmounted or mounted on an SEM stub of your choice. SEM Mount selection A-P on page 487.

Certification: Supplied with a non-traceable manufacturer's certificate stating average pitch, based on batch measurements.

300nm 2D AFM Reference Standard, Certified, Non-traceable, Mounted on Disk

16475-1AFM 300nm 2D Resolution AFM Reference Standard on12mm steel disk . . . . . .each

300nm 2D SEM, Auger and FIB Reference Standard, Certified, Non-traceable Unmounted or Mounted (mount description A - P on page 31)

16475-1 300nm 2D Resolution AFM Reference Standard, unmounted . . . . . .each

16475-1A 300nm 2D Resolution AFM Reference Standard, on Mount A . . . . . .each

16475-1B 300nm 2D Resolution AFM Reference Standard, on Mount B . . . . . .each

16475-1C 300nm 2D Resolution AFM Reference Standard, on Mount C . . . . . .each

16475-1D 300nm 2D Resolution AFM Reference Standard, on Mount D . . . . . .each

16475-1E 300nm 2D Resolution AFM Reference Standard, on Mount E . . . . . .each

16475-1F 300nm 2D Resolution AFM Reference Standard, on Mount F . . . . . .each

16475-1G 300nm 2D Resolution AFM Reference Standard, on Mount G, you supply mount each

16475-1K 300nm 2D Resolution AFM Reference Standard, on Mount K . . . . . .each

16475-1L 300nm 2D Resolution AFM Reference Standard, on Mount L . . . . . .each

16475-1M 300nm 2D Resolution AFM Reference Standard, on Mount M . . . . . .each

16475-1O 300nm 2D Resolution AFM Reference Standard, on Mount O . . . . . .each

16475-1P 300nm 2D Resolution AFM Reference Standard, on Mount P . . . . . .each

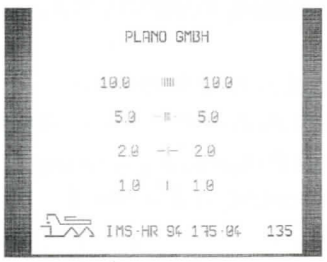
■ Critical Dimension (CD) Calibration Test Specimens

for SEM, FIB, and AFM

"Critical Dimension (CD) structures" are particularly useful for SEM / FIB magnification calibration and may be used for AFM.

Microscopists and engineers using high performance SEMs or FIB systems will find this calibration test specimen useful. The 4.8 x 4.8mm silicon standard has a series of patterns with a side length of 480µm around its edges, helpful for orientation. There are three versions available.

See mount selections, types A-P, on page 31



Version with a 10-5-2-1µm with a central area comprises four line patterns, each one clearly identified by its pitch. Each pattern has five bars and spaces of equal pitch: 1.0µm, 2.0µm, 5.0µm and 10.0µm. The central line structure area may be used for AFM measurements. The patterns are etched into Si, approximately 200nm deep. The patterns are therefore slightly lower than the Si surface. There is no coating on the Si surface.

Each standard is identified by a serial number.

Unmounted

618-1 CD Structure 1-2-5-10µm Specimen, Non-certified, Unmounted . . . . . .each

Mounted Non-certified (mount description A - M on page 31)

618-1A CD Structure 1-2-5-10µm Specimen, Non-certified, Mount A . . . . . .each

618-1B CD Structure 1-2-5-10µm Specimen, Non-certified, Mount B . . . . . .each

618-1C CD Structure 1-2-5-10µm Specimen, Non-certified, Mount C . . . . . .each

618-1D CD Structure 1-2-5-10µm Specimen, Non-certified, Mount D . . . . . .each

618-1E CD Structure 1-2-5-10µm Specimen, Non-certified, Mount E . . . . . .each

618-1F CD Structure 1-2-5-10µm Specimen, Non-certified, Mount F . . . . . .each

618-1G CD Structure 1-2-5-10µm Specimen, Non-certified, Mount G, you supply mount . .each

618-1K CD Structure 1-2-5-10µm Specimen, Non-certified, Mount K . . . . . .each

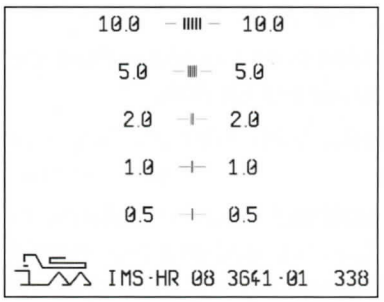
618-1L CD Structure 1-2-5-10µm Specimen, Non-certified, Mount L . . . . . .each

618-1M CD Structure 1-2-5-10µm Specimen, Non-certified, Mount M . . . . . .each

618-1O CD Structure 1-2-5-10µm Specimen, Non-certified, Mount O . . . . . .each

618-1P CD Structure 1-2-5-10µm Specimen, Non-certified, Mount P . . . . . .each

Version with a 10-5-2-1-0.5um Structure



This CD calibration test specimen comprises 5 line patterns, each one clearly identified by its pitch. Each pattern has five bars and spaces of equal pitch:10.0µm, 5.0µm, 2.0µm, 1.0µm and 0.5µm. The central line area may be used for AFM measurements. The patterns are etched into Si at a depth of approximately 200nm. There is no coating on the Si surface.

Unmounted

618-5 CD Structure 10-5-2-1-0.5µm Specimen, non-certified, unmounted . . . . . .each

618-7 CD Structure 10-5-2-1-0.5µm Specimen, certified traceable by German Physikalische Technical Bundesanstalt, unmounted . . . . . .each

Mounted Non-certified (mount description A - M on page 31)

618-5A CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount A . . . . . .each

618-5B CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount B . . . . . .each

618-5C CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount C . . . . . .each

618-5D CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount D . . . . . .each

618-5E CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount E . . . . . .each

618-5F CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount F . . . . . .each

618-5G CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount G, you supply mount . .each

618-5K CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount K . . . . . .each

618-5L CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount L . . . . . .each

618-5M CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount M . . . . . .each

618-5O CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount O . . . . . .each

618-5P CD Structure 10-5-2-1-0.5µm Specimen, Non-certified, Mount P . . . . . .each

Mounted, Certified by the German Physikalische Technische Bundesanstalt (mount description A - P on page 31)

618-7A CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount A . . . . . .each

618-7B CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount B . . . . . .each

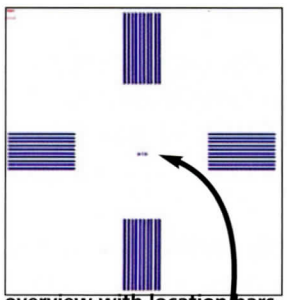
618-7C CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount C . . . . . .each

■ Critical Dimension (CD) Calibration Test Specimens *continued*

For SEM, FIB, and AFM Mounted, Certified by the German Physikalische Technische Bundesanstalt *continued*
(mount description A - P on page 31)

618-7D CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount D . . . . . .each
618-7E CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount E . . . . . .each
618-7F CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount F . . . . . .each
618-7G CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount G, you supply mount . . . .each
618-7K CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount K . . . . . .each
618-7L CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount L . . . . . .each
618-7M CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount M . . . . . .each
618-7O CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount O . . . . . .each
618-7P CD Structure 10-5-2-1-0.5µm Specimen, Certified, Mount P . . . . . .each

Version with a 500-200-100nm Structure



overview with location bars

structure

This advanced CD calibration test specimen is suited for calibrating smaller structures. The 500-200-100nm test specimen comprises 3 line patterns, each identified by its pitch. Each pattern has 5 bars and spaces with equal pitch: 500nm, 200nm and 100nm. The central area may be used for AFM measurements. The patterns are etched into Si with a depth of approx. 45-50nm. There is no coating on the Si surface. On some CD calibration targets one of the 100nm lines can be missing. This is a normal occurrence and does not influence performance of the specimen.

Unmounted

618-4 CD Structure 500-200-100nm Specimen, Non-certified, unmounted . . . . . .each

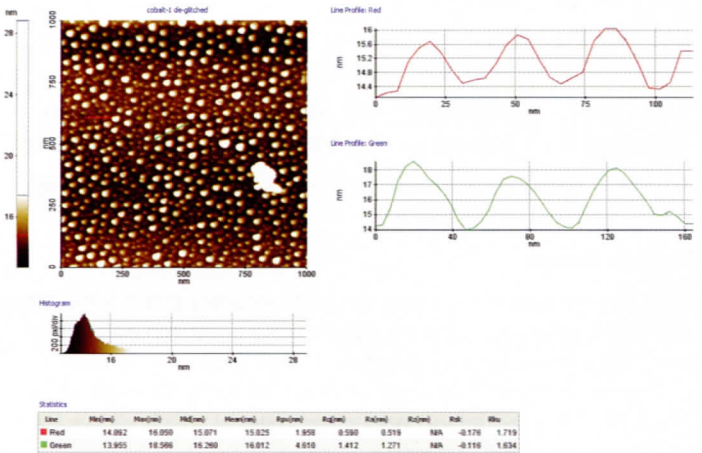
Mounted Non-certified (mount description A - P on page 31)

618-4A CD Structure 500-200-100nm Specimen, Non-certified, Mount A . . . . . .each
618-4B CD Structure 500-200-100nm Specimen, Non-certified, Mount B . . . . . .each
618-4C CD Structure 500-200-100nm Specimen, Non-certified, Mount C . . . . . .each
618-4D CD Structure 500-200-100nm Specimen, Non-certified, Mount D . . . . . .each
618-4E CD Structure 500-200-100nm Specimen, Non-certified, Mount E . . . . . .each
618-4F CD Structure 500-200-100nm Specimen, Non-certified, Mount F . . . . . .each
618-4G CD Structure 500-200-100nm Specimen, Non-certified, Mount G, you supply mount . .each
618-4K CD Structure 500-200-100nm Specimen, Non-certified, Mount K . . . . . .each
618-4L CD Structure 500-200-100nm Specimen, Non-certified, Mount L . . . . . .each
618-4M CD Structure 500-200-100nm Specimen, Non-certified, Mount M . . . . . .each
618-4O CD Structure 500-200-100nm Specimen, Non-certified, Mount O . . . . . .each
618-4P CD Structure 500-200-100nm Specimen, Non-certified, Mount P . . . . . .each

■ PELCO® AFM Tip and Resolution Test Specimen

Colloidal cobalt provides an excellent substrate for AFM tip characterization and instrument operation. Image at top demonstrates height calibration at 1nm (red line profile) and 3nm (green line profile) on the standard.

Available on 5x5mm silicon wafer chips unmounted or mounted on 12mm stainless steel metal disk. Tip characterization down to angstrom resolution is easily attained. Image at top demonstrates 1 and 3nm height resolution accurate to 0.05nm.

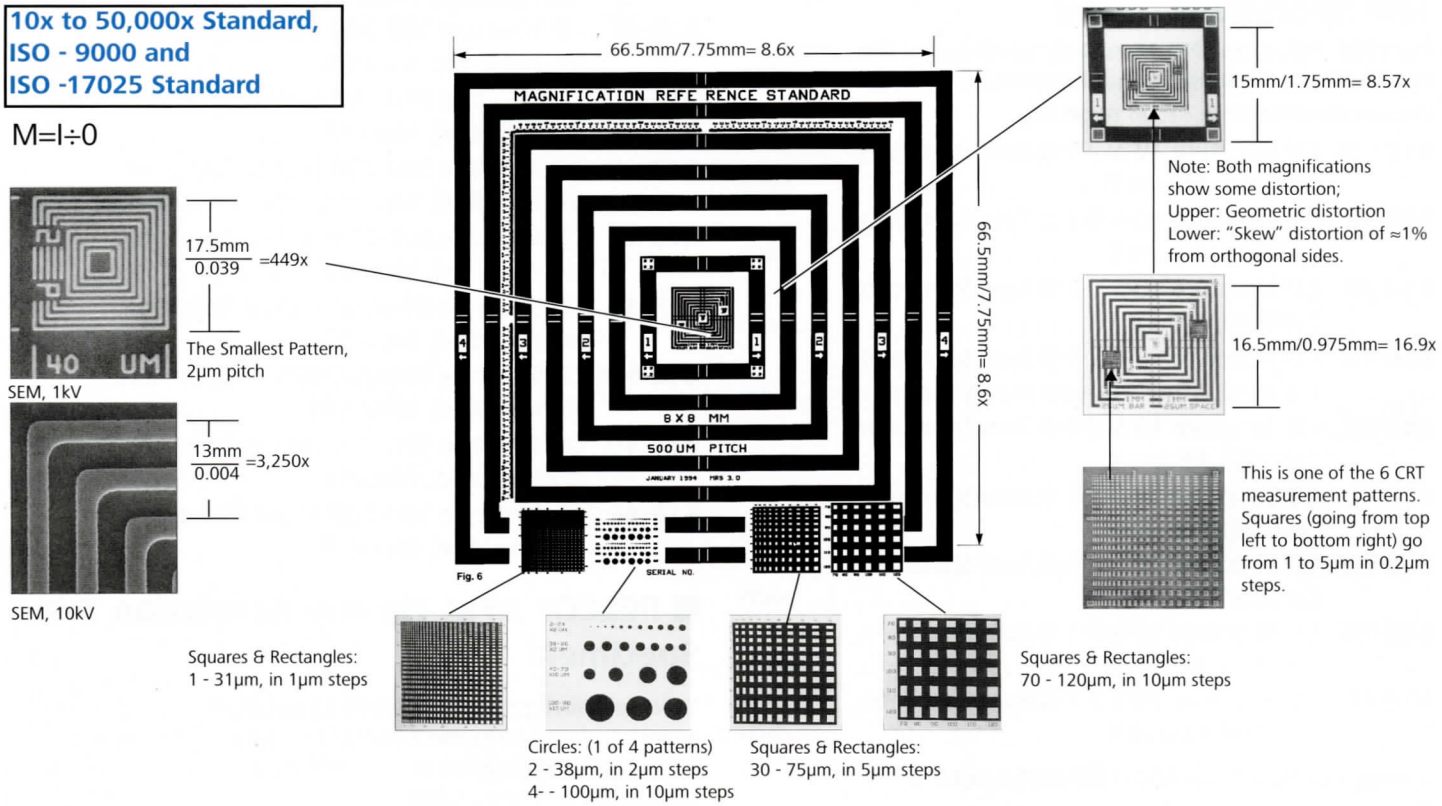


628 PELCO® AFM Tip and Resolution Test Specimen, Unmounted . . . . . .each
628-AFM PELCO® AFM Tip and Resolution Test Specimen, Mount AFM . . . . . .each

■ SEM Magnification Calibration MRS-3 *The 10 x 50,000x Pitch Standard for Scanning Electron Microscopy*

**10x to 50,000x Standard,
ISO - 9000 and
ISO -17025 Standard**

M=I÷0



Applications

- Electron microscopy - SEM, in both SE and BSE mode, SEM/FIB and TEM (with special version)
- Scanning Microscopies and Profilometry - STM, AFM, the pattern height is 100nm
- Optical Microscopy - transmitted, reflected, bright/dark field, differential contrast and confocal
- Chemical mapping - EDS, WDS, XRF, XPS, Auger and others. The pattern is fabricated using 100nm CrO_2 and Cr on quartz
- Particle Size Counting - series of circles, squares and rectangles for calibration confirmation

Pattern Design

The MRS-3 is fabricated using the high accuracy direct write electron beam manufacturing equipment. The pattern is anti-reflective chromium on a glass standard. Imaging contrast in both secondary and back scattered mode is very high. The pattern is coated with a proprietary conductive material which allows for SEM imaging at any accelerating voltage.

Magnification Reference Standards

614-1 MRS-3 Reference Standard, X, Not Traceable, without Protective Retainer . . . . . .each

614-2 MRS-3 Reference Standard, X-Y, Traceable, without Protective Retainer . . . . . .each

614-3 MRS-3 Reference Standard, X-Y-Z, Traceable, without Protective Retainer . . . . . .each

Retainer for MRS-3

614-5 Protective Retainer, SEM, 1" dia. x 0.125" (25.4 x 3.18mm) with clear hole for transmission measurements. Standard recessed 0.02" (0.5mm), aluminum, Ni plated . . . . . .each

Adapters

614-7 Adapter MRS-3/4 only, specify AMRAY, Leica each

614-6 Optical Microscope Adapter OM/R 1.75" x 0.125" (44.5 x 3.18mm) with clear hole for transmission measurements. Standard slightly recessed 0.005" (0.13mm), aluminum, Ni plated . . . . . .each

Modification

614-61A Modify the MRS-3 to 3mm diameter x 0.5mm thickness to fit into a TEM style holder. For use only in secondary or backscattered electron mode, not transmitted. . . . . .each

Specimen Mount

614-62 Mounting MRS-3/4/5, Pin Stub (Specimen Mount), commonly used SEM stubs with a ⅛" (3.2mm) pin and 1" (25.4mm) surface . . . .each

Cleaning and Re-calibration Service

614-71A MRS-3 X-Y/R Cleaning, Re-coating and Re-calibration . . . . . .each

614-72A MRS-3 X-Y-Z/R Cleaning, Re-coating and Re-calibration . . . . . .each

614-73 MRS-3/4/5 Cleaning and Re-coating only . .each

see web page: www.tedpella.com/Calibrat_html/614-1.htm

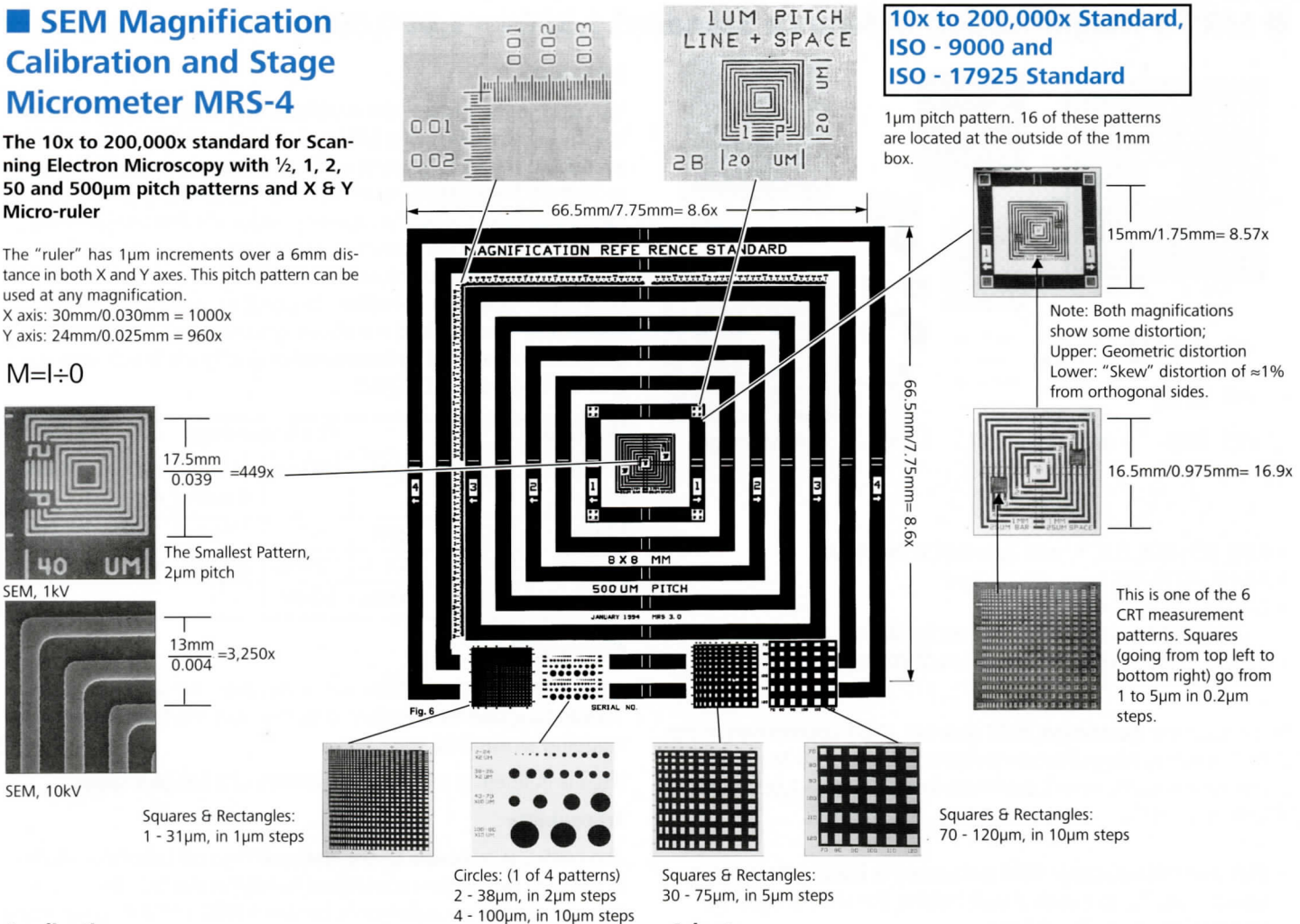
SEM Magnification Calibration and Stage Micrometer MRS-4

The 10x to 200,000x standard for Scanning Electron Microscopy with ½, 1, 2, 50 and 500µm pitch patterns and X & Y Micro-ruler

10x to 200,000x Standard, ISO - 9000 and ISO - 17925 Standard

The "ruler" has 1µm increments over a 6mm distance in both X and Y axes. This pitch pattern can be used at any magnification.
X axis: 30mm/0.030mm = 1000x
Y axis: 24mm/0.025mm = 960x

M=I÷O



Applications

See MRS-3, Previous page for applications

Pattern Design

The MRS-4 is fabricated using the high accuracy direct write electron beam manufacturing equipment. The pattern is anti-reflective chromium on a glass standard. Imaging contrast in both secondary and back scattered mode is very high. The pattern is coated with a proprietary conductive material which allows for SEM imaging at any accelerating voltage.

Magnification Reference Standards

614-821 MRS-4 Reference Standard, X, Not Traceable, without Protective Retainer . . . . . .each

614-822 MRS-4 Reference Standard, X-Y, Traceable, without Protective Retainer . . . . . .each

614-823 MRS-4 Reference Standard, X-Y-Z, Traceable, without Protective Retainer . . . . . .each

Retainer for MRS-4

614-5 Protective Retainer, SEM, 1" dia. x 0.125" (25.4 x 3.18mm) with clear hole for transmission measurements. Standard recessed 0.02" (0.5mm), aluminum, Ni plated . . . . . .each

Adapters

614-7 Adapter MRS-3/4 only, specify AMRAY, Leica each

614-6 Optical Microscope Adapter OM/R 1.75" x 0.125" (44.5 x 3.18mm) with clear hole for transmission measurements. Standard slightly recessed 0.005" (0.13mm), aluminum, Ni plated . . . . . .each

Modification

614-61B Modify the MRS-4 to 3mm diameter x 0.5mm thickness to fit into a TEM style holder. For use only in secondary or backscattered electron mode, not transmitted. . . . . .each

Specimen Mount

614-62 Mounting MRS-3/4/5, Pin Stub (Specimen Mount), commonly used SEM stubs with a ⅛" (3.2mm) pin and 1" (25.4mm) surface . . . .each

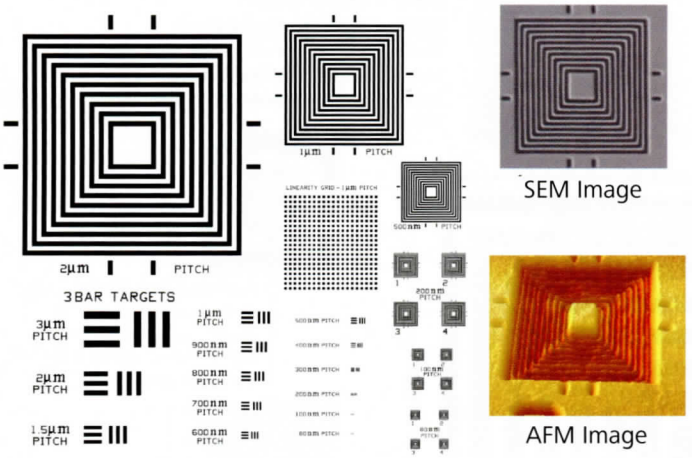
Cleaning and Re-calibration Service

614-71B MRS-4 X-Y/R Cleaning, Re-coating and Re-calibration . . . . . .each

614-72B MRS-4 X-Y-Z/R Cleaning, Re-coating and Re-calibration . . . . . .each

614-73 MRS-3/4/5 Cleaning and Re-coating only . .each

MRS-5 Magnification Reference Standard 1,500x - 1,000,000x *! Latest Development*



- 0.08, 0.1, 0.2, 0.5, 1, and 2µm PITCH PATTERNS
- 3 BAR PATTERNS from .08 TO 3µm
- 1µM PITCH TEST GRID X 20µm
- ± 3 NM INDIVIDUAL PITCH 2ø UNCERTAINTY
- ± 2NM CUMULATIVE PITCH 2ø UNCERTAINTY

This is the next generation, NIST and NPL (NIST counterpart in the U.K.) Traceable, Magnification Reference Standard & Stage Micrometer. For Instrument Calibration from 1,500x – 1,000,000x (80nm min. pitch).

- **Electron Microscopy:** SEM (secondary & backscattered electrons), TEM (for use with a bulk holder; the MRS-5 is conveniently sized at 2 x 2 x 0.5mm).
- **Scanning Microscopies and Profilometry:** STM, AFM, stylus and optical, etc. The pattern height is 0.1µm.
- **Optical Microscopy:** Reflected, bright/dark field, differential contrast, and confocal.
- **Chemical Mapping:** EDS, WDS, micro/macro XRF, XPS, Auger & others. The pattern is fabricated using 100nm tungsten film over a thin SiO^2 film over a silicon substrate.
- **Resolution Testing:** With a series of 2 bar targets (similar to the USAF 1953 patterns) ranging in size from 80nm to 3µm.
- **Linearity Testing:** With a $1\mu m^2$ pitch over 40 x 40µm.
- **A Standard Ahead of Its Time:** The MRS-5 represents a challenging next step. The nanotechnology sized patterns will be a good test of your imaging systems.
  - Advanced optical microscopes now have submicrometer test patterns to measure resolution and linearity.
  - Scanning electron microscopes have a pattern that will show significant differences between backscattered and secondary electron type I and type II images. Imaging the pattern will also tax their low accelerating voltage capabilities.
  - Scanning probe microscopes have a pattern that is closely sized to the finest cantilever tips challenging their resolution ability.

Introduction

Introducing the MRS-5, the next level in a series of magnification calibration standards (the MRS-1, MRS-3 and MRS-4 are currently available). The MRS series of calibration standards are highly accepted pitch standards, with well over 1,000 being used in laboratories around the world including national laboratories in the US, UK and Germany. Industrial customers include the leading semiconductor manufacturers. The MRS-5 is offered as a certified reference material (a traceable standard) or, optionally, without traceability. Also offered is a cleaning service and a recertification program, as required by international quality standards such as ISO, QS-9000 and ISO-17025.

Pattern	Pitch Spacings					
Nested boxes	2µm	1µm	500nm	200nm 4 each	100nm 4 each	800nm 4 each
3 bar targets	3µm	2µm	1µm	1.5µm	1µm	900nm
	800nm	700nm	600nm	500nm	400nm	300nm
	200nm	100nm	80nm			

Construction

2mm x 2mm x 0.5mm thick silicon die with thin SiO2 film then 100nm tungsten film. Pattern is etched into the tungsten film stopping at the SiO2 layer.

Pitch is defined as a cycle, the distance of a bar plus space.

Traceability

The MRS-5 is traceable to the National Physical Laboratory (NPL) in the U.K. NPL is the counterpart to NIST in the U.S. There is a mutual recognition agreement between NIST and NPL concerning each others' measurements.

Geometric Design

It should be noted that some high resolution standards are traceable through optical diffraction methods to determine the pattern frequency which does not account for frequency variations in the pattern. We do it correctly, measuring and providing traceability to the individual pattern.

Magnification Reference Standards

614-50 MRS-5NT Reference Standard, X, Not Traceable, without Protective Retainer . . . . . .each

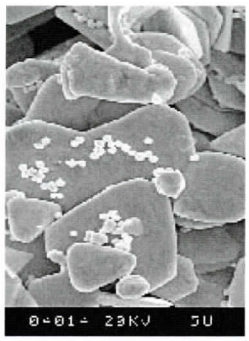
614-51 MRS-5XY Reference Standard, X-Y, Traceable, without Protective Retainer . . . . . .each

Modification

614-61C Modify the MRS-5 to 3mm diameter x 0.5mm thickness to fit into a TEM style holder. For use only in secondary or backscattered electron mode, not transmitted. . . . . .each

Cleaning and Re-calibration Service

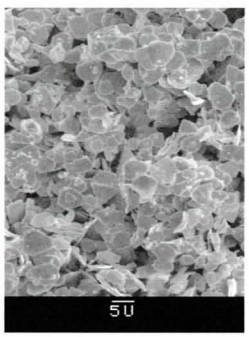
614-73 MRS-3/4/5 Cleaning and Re-coating only . .each



SEM Astigmatism Correction and Resolution Determination

Clear, sharp, high contrast images easy to stigmate and use for checking resolution.

Sharp-edged gold particles on 1000 mesh grids attached to any specimen mount of the group listed below.



This specimen is used to:

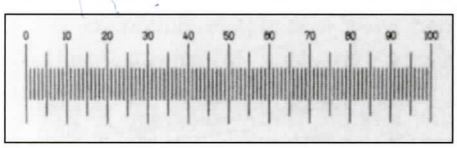
1. Determine the presence of astigmatism and allow correction
2. Determine instrument resolution.

See drawings to identify specimen mount and the correct ordering number. The specimen may also be prepared on a custom mount of your choice. (mount description S - P on page 31) ⓣ

640 PELCO® Astigmatism Corrector, unmounted .each
640-A PELCO® Astigmatism Corrector, Mount A . . .each
640-B PELCO® Astigmatism Corrector, Mount B . . . .each
640-C PELCO® Astigmatism Corrector, Mount C . . .each
640-D PELCO® Astigmatism Corrector, Mount D . . .each
640-E PELCO® Astigmatism Corrector, Mount E . . . .each
640-F PELCO® Astigmatism Corrector, Mount F . . . .each
640-G PELCO® Astigmatism Corrector, your mount .each
640-K PELCO® Astigmatism Corrector, Mount K . . .each
640-L PELCO® Astigmatism Corrector, Mount L . . . .each
640-M PELCO® Astigmatism Corrector, Mount M . . .each
640-O PELCO® Astigmatism Corrector, Mount O . . .each
640-P PELCO® Astigmatism Corrector, Mount P . . . .each

Low-Mag Calibration Ruler

100 markings, divisions 0.01mm on disc

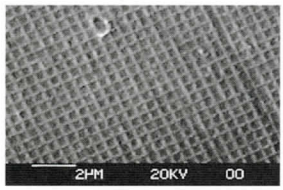


Nickel-plated copper calibration ruler disc. Select a mount of your choice listed below. If you wish to specify an unlisted mount, choose 630. Mounted Discs are listed below. A 500, 1000 or 2000 mesh grid or magnetic tape mounted with the Disk may be ordered as a special (not listed). ⓣ

630 Lo-mag Calibration Disc, Special Mount . . . .each
630-A Lo-mag Calibration Disc, Mount A . . . . . .each
630-B Lo-mag Calibration Disc, Mount B . . . . . .each
630-C Lo-mag Calibration Disc, Mount C . . . . . .each
630-D Lo-mag Calibration Disc, Mount D . . . . . .each
630-E Lo-mag Calibration Disc, Mount E . . . . . .each
630-F Lo-mag Calibration Disc, Mount F . . . . . .each
630-G Lo-mag Calibration Disc, your mount . . . . . .each
630-K Lo-mag Calibration Disc, Mount K . . . . . .each
630-L Lo-mag Calibration Disc, Mount L . . . . . .each
630-M Lo-mag Calibration Disc, Mount M . . . . . .each
630-O Lo-mag Calibration Disc, Mount O . . . . . .each
630-P Lo-mag Calibration Disc, Mount P . . . . . .each

See Mount Selections, A-P on page 31

Grating Replica, Waffle

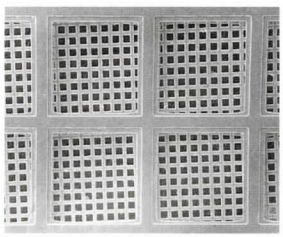


(Crossed-Lines)

Shadowcast carbon and/or silicon monoxide prepared on a mount of your choice and carefully packaged. 2,160 lines per millimeter. "604" is used for special orders, or unlisted mounts. ⓣ

604 SEM Grating Replica, unmounted . . . . . .each
604-A SEM Grating Replica, Mount A . . . . . .each
604-B SEM Grating Replica, Mount B . . . . . .each
604-C SEM Grating Replica, Mount C . . . . . .each
604-D SEM Grating Replica, Mount D . . . . . .each
604-E SEM Grating Replica, Mount E . . . . . .each
604-F SEM Grating Replica, Mount F . . . . . .each
604-G SEM Grating Replica, you supply mount . . . .each
604-K SEM Grating Replica, Mount K . . . . . .each
604-L SEM Grating Replica, Mount L . . . . . .each
604-M SEM Grating Replica, Mount M . . . . . .each
604-O SEM Grating Replica, Mount O . . . . . .each
604-P SEM Grating Replica, Mount P . . . . . .each

Copper Mesh on Folding Grids



For calibrating scanning electron microscopes and the low magnification range of transmission electron microscopes. The mesh is held within a folding grid.

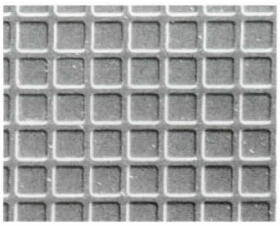
631-A, 1000 mesh has a 50% open area, pitch 25µm, hole 19µm, bar 7 µm.
631-A 1000 mesh on 3mm Folding Grid . . . . . .each

631-C, 2000 mesh has a 36% open area, pitch 12.5µm, hole 7.5µm, bar 5 µm.
631-C 2000 mesh on 3mm Folding Grid . . . . . .each

ⓣ= Tech Note on web page

Planotec Silicon Test Specimen

magnification calibration image distortion check for SEM and LM



Single crystal silicon, 5mm x 5mm. The squares repeat every 10µm (0.01mm). The dividing lines are about 1.9µm wide, formed by electron beam lithography. A broader marking line is written every 500µm (0.5mm) which is useful for light microscopy. Lines and squares are etched, approximately 1.9µm wide x 200nm deep.

Many types of samples can be mounted directly onto the Silicon Test Specimen so that an internal calibration is obtained on the micrograph.

A certificate of calibration can be supplied for the Silicon Test Specimen at extra cost. The guaranteed accuracy is 1%. The basic reference specimen is calibrated by the National Physical Laboratory, of England, by laser beam interferometry. T

615 Planotec Silicon Test Specimen, unmounted .each
615-A Planotec Silicon Test Specimen, Mount A . . .each
615-B Planotec Silicon Test Specimen, Mount B . . . .each
615-C Planotec Silicon Test Specimen, Mount C . . .each
615-D Planotec Silicon Test Specimen, Mount D . . .each
615-E Planotec Silicon Test Specimen, Mount E . . . .each
615-F Planotec Silicon Test Specimen, Mount F . . . .each
615-G Planotec Silicon Test Specimen, your mount .each
615-K Planotec Silicon Test Specimen, Mount K . . .each
615-L Planotec Silicon Test Specimen, Mount L . . . .each
615-M Planotec Silicon Test Specimen, Mount M . . .each
615-O Planotec Silicon Test Specimen, Mount O . . .each
615-P Planotec Silicon Test Specimen, Mount P . . . .each
615-5 Planotec test specimen for incident LM, mounted on a blackened glass slide . . . . . .each

Planotec Silicon Test Specimens with calibration certificate for mounted test specimens only

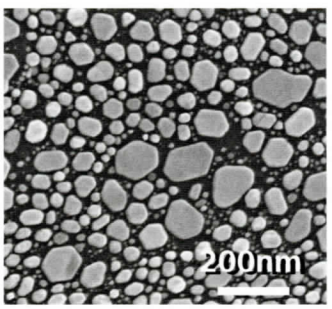
660-615-A Planotec Silicon Test Specimen, certified, Mount A . . . . . .each
660-615-B Planotec Silicon Test Specimen, certified, Mount B . . . . . .each
660-615-C Planotec Silicon Test Specimen, certified, Mount C . . . . . .each
660-615-D Planotec Silicon Test Specimen, certified, Mount D . . . . . .each
660-615-E Planotec Silicon Test Specimen, certified, Mount E . . . . . .each
660-615-F Planotec Silicon Test Specimen, certified, Mount F . . . . . .each
660-615-G Planotec Silicon Test Specimen, certified, you supply mount . . . . . .each
660-615-K Planotec Silicon Test Specimen, certified, Mount K . . . . . .each
660-615-L Planotec Silicon Test Specimen, certified, Mount L . . . . . .each
660-615-M Planotec Silicon Test Specimen, certified, Mount M . . . . . .each
660-615-O Planotec Silicon Test Specimen, certified, Mount O . . . . . .each
660-615-P Planotec Silicon Test Specimen, certified, Mount P . . . . . .each
660-615-5 Planotec test specimen for incident light microscopy, certified, mounted on a blackened glass slide . . . . . .each

Standard Gold on Carbon Test Specimens for SEM Resolution, High Resolution, Ultra High Resolution & Low Voltage Resolution

Scanning electron microscopy resolution is tested in terms of a combination of criteria; namely, resolved gaps and the number of gray levels in the image. This is to ensure that the resolution has not been distorted by using the contrast to maximize visibility of edges. High resolution images ideally should show fine detail together with a lack of noise evidenced by a good range of gray levels.

Three special high resolution and one low voltage test specimens, gold on carbon and are excellent for SEM and FE SEM resoluton calibration. (mount description A - P on page 31) T

Standard Resolution Test Specimen, Gold on Carbon 1



particle size range from approximately 5nm to 150nm

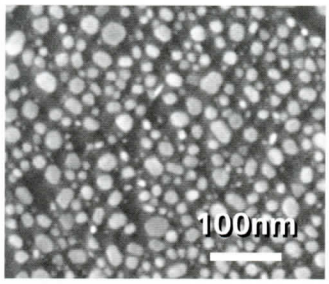
Each specimen has a square grid pattern with large crystals in the center of each square and very fine crystals at the edges of each grid (as illustrated). Thus, medium and high resolution gap tests are performed on the same specimen. The larger crystals show facets which allow assessment of the gray level reproduction available at high resolution. T

617 Resolution Gold on Carbon, unmounted . . . .each
617-A Resolution Gold on Carbon, Mount A . . . . . .each
617-B Resolution Gold on Carbon, Mount B . . . . . .each
617-C Resolution Gold on Carbon, Mount C . . . . . .each
617-D Resolution Gold on Carbon, Mount D . . . . . .each
617-E Resolution Gold on Carbon, Mount E . . . . . .each
617-F Resolution Gold on Carbon, Mount F . . . . . .each
617-G Resolution Gold on Carbon, your mount . . . .each
617-K Resolution Gold on Carbon, Mount K . . . . . .each
617-L Resolution Gold on Carbon, Mount L . . . . . .each
617-M Resolution Gold on Carbon, Mount M . . . . . .each
617-O Resolution Gold on Carbon, Mount O . . . . . .each
617-P Resolution Gold on Carbon, Mount P . . . . . .each

T = Tech Note on web page

continued on next page

High Resolution Test Specimen, Gold on Carbon 2



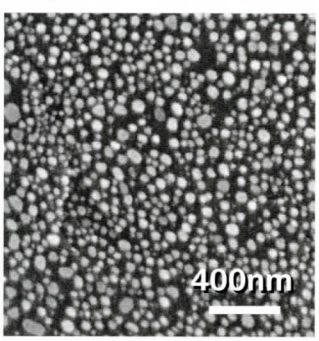
particle size range from <3nm to 50nm

Particularly suited for assessing the image quality of high resolution SEMs, such as those fitted with a field emission source. A magnification of at least 80,000x is required to clearly resolve the gold particles. (mount description A - P on page 31) T

617-2 High Resolution Gold on Carbon Spec. 2, unmounted . . . . . each
617-2A High Resolution Gold on Carbon Spec. 2, Mount A . . . . . each
617-2B High Resolution Gold on Carbon Spec. 2, Mount B . . . . . each
617-2C High Resolution Gold on Carbon Spec. 2, Mount C . . . . . each
617-2D High Resolution Gold on Carbon Spec. 2, Mount D . . . . . each
617-2E High Resolution Gold on Carbon Spec. 2, Mount E . . . . . each
617-2F High Resolution Gold on Carbon Spec. 2, Mount F . . . . . each
617-2G High Resolution Gold on Carbon Spec. 2, you supply mount . . . . . each
617-2K High Resolution Gold on Carbon Spec. 2, Mount K . . . . . each
617-2L High Resolution Gold on Carbon Spec. 2, Mount L . . . . . each
617-2M High Resolution Gold on Carbon Spec. 2, Mount M . . . . . each
617-2O High Resolution Gold on Carbon Spec. 2, Mount O . . . . . each
617-2P High Resolution Gold on Carbon Spec. 2, Mount P . . . . . each

(see mount selections guide A - P on page 31)

Ultra High Resolution Test Specimen, Gold on Carbon 3

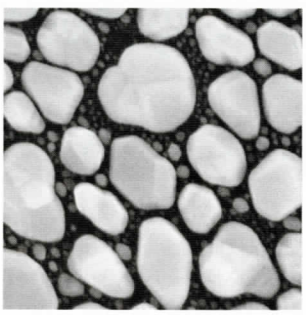


particle size range from <2nm to 30nm

For ultra high resolution performance testing, this specimen has a smaller gold island particle size compared to the 617 specimen described previously. Suitable for testing a field emission SEM at instrument magnifications of 100,000x and above. (mount description A - P on page 31) T

617-3 Ultra High Resolution Gold on Carbon Spec. 3, unmounted . . . . . each
617-3A Ultra High Resolution Gold on Carbon Spec. 3, Mount A . . . . . each
617-3B Ultra High Resolution Gold on Carbon Spec. 3, Mount B . . . . . each
617-3C Ultra High Resolution Gold on Carbon Spec. 3, Mount C . . . . . each
617-3D Ultra High Resolution Gold on Carbon Spec. 3, Mount D . . . . . each
617-3E Ultra High Resolution Gold on Carbon Spec. 3, Mount E . . . . . each
617-3F Ultra High Resolution Gold on Carbon Spec. 3, Mount F . . . . . each
617-3G Ultra High Resolution Gold on Carbon Spec. 3, Mount G, you supply mount . . . . . each
617-3K Ultra High Resolution Gold on Carbon Spec. 3, Mount K . . . . . each
617-3L Ultra High Resolution Gold on Carbon Spec. 3, Mount L . . . . . each
617-3M Ultra High Resolution Gold on Carbon Spec. 3, Mount M . . . . . each
617-3O Ultra High Resolution Gold on Carbon Spec. 3, Mount O . . . . . each
617-3P Ultra High Resolution Gold on Carbon Spec. 3, Mount P . . . . . each

Low Voltage Resolution Test Specimen, Gold on Carbon 4



particle sizes range from 30nm to 500nm

When operating at low accelerating voltages or using older instruments, difficulties may be experienced in imaging the standard gold on carbon resolution specimen. This may be due to inferior resolution at low voltage or poor signal to noise ratio when operating at high scanning rates with small spot sizes. The larger gold islands give high contrast while retaining small gaps for resolution measurement. This makes the specimen easier to use at non-optimal operating conditions. (mount description A - P on page 31) T

617-4 Low Voltage Gold on Carbon Spec. 4, Unmounted . . . . . each
617-4A Low Voltage Gold on Carbon Spec. 4, Mount A . . . . . each
617-4B Low Voltage Gold on Carbon Spec. 4, Mount B . . . . . each
617-4C Low Voltage Gold on Carbon Spec. 4, Mount C . . . . . each

T= Tech Note on web page

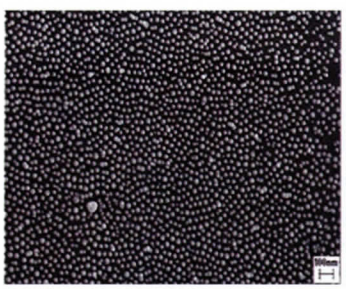
continued on next page

■ Low Voltage Resolution Test Specimen, Gold on Carbon 4 *continued*

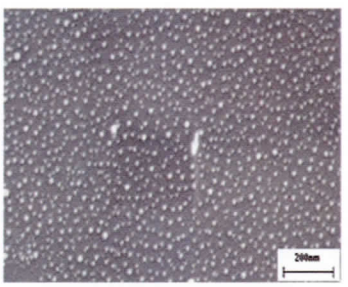
617-4D Low Voltage Gold on Carbon Spec. 4, Mount D . . . . . .each
617-4E Low Voltage Gold on Carbon Spec. 4, Mount E . . . . . .each
617-4F Low Voltage Gold on Carbon Spec. 4, Mount F . . . . . .each
617-4G Low Voltage Gold on Carbon Spec. 4, you supply mount . . . . . .each
617-4K Low Voltage Gold on Carbon Spec. 4, Mount K . . . . . .each
617-4L Low Voltage Gold on Carbon Spec. 4, Mount L . . . . . .each
617-4M Low Voltage Gold on Carbon Spec. 4, Mount M . . . . . .each
617-4O Low Voltage Gold on Carbon Spec. 4, Mount O . . . . . .each
617-4P Low Voltage Gold on Carbon Spec. 4, Mount P . . . . . .each

■ PELCO® Nanogold Resolution Test Standards for SEM and FESEM

SEM High Resolution Standard and Size Reference Indicator



30nm



15nm

These unique gold nano particles on silicon provide resolution standards with known and uniform particle size, ideally suited for high resolution tests for SEM, FESEM and FIB/SEM systems. The known particle paired with uniformity provides a real indication of the performance of the SEM or FESEM. The nano gold on silicon resolution standards are available in two size ranges:

- 30nm for high resolution SEM applications (size is 30nm ± 4nm)
- 15nm for ultrahigh resolution FESEM applications

Provided on a 5 x 5mm silicon wafer chip, unmounted or provided on the specimen mount of your choice. See mount selections A-P. **(on pages 31)**

PELCO® Nanogold Resolution Test Standard with 30nm gold particles.

680 PELCO® Nanogold High Resolution Test SEM Standard, unmounted . . . . . .each
680-A PELCO® Nanogold High Resolution Test SEM Standard, Mount A . . . . . .each
680-B PELCO® Nanogold High Resolution Test SEM Standard, Mount B . . . . . .each
680-C PELCO® Nanogold High Resolution Test SEM Standard, Mount C . . . . . .each
680-D PELCO® Nanogold High Resolution Test SEM Standard, Mount D . . . . . .each
680-E PELCO® Nanogold High Resolution Test SEM Standard, Mount E . . . . . .each
680-F PELCO® Nanogold High Resolution Test SEM Standard, Mount F . . . . . .each
680-G PELCO® Nanogold High Resolution Test SEM Standard, Mount G, You Supply Mount . . . . .each
680-K PELCO® Nanogold High Resolution Test SEM Standard, Mount K . . . . . .each
680-L PELCO® Nanogold High Resolution Test SEM Standard, Mount L . . . . . .each
680-M PELCO® Nanogold High Resolution Test SEM Standard, Mount M . . . . . .each
680-O PELCO® Nanogold High Resolution Test SEM Standard, Mount O . . . . . .each
680-P PELCO® Nanogold High Resolution Test SEM Standard, Mount P . . . . . .each

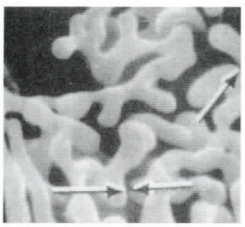
PELCO® Nanogold Resolution Test Standard with 15nm gold particles.

681 PELCO® Nanogold Ultra-High Resolution Test SEM Standard, unmounted . . . . . .each
681-A PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount A . . . . . .each
681-B PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount B . . . . . .each
681-C PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount C . . . . . .each
681-D PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount D . . . . . .each
681-E PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount E . . . . . .each
681-F PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount F . . . . . .each
681-G PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount G, You Supply Mount . . . . .each
681-K PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount K . . . . . .each
681-L PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount L . . . . . .each
681-M PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount M . . . . . .each
681-O PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount O . . . . . .each
681-P PELCO® Nanogold Ultra-High Resolution Test SEM Standard, Mount P . . . . . .each

SEM Medium Resolution Test Specimens

■ Aluminum-Tungsten Dendrites

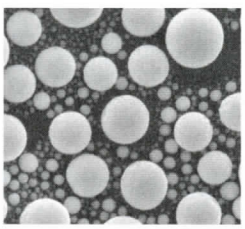
medium resolution test for SEM



The various spacings created by the dendritic structure give the gap test. The topographical arrangement of dendrites leads to the gray level test. The specimen is non-magnetic, vacuum clean, has no adverse reaction to the electron probe and requires no surface coating. It is most useful for working in the probe size range of 25 to 75nm. This standard is supplied unmounted with instructions and with an SEM micrograph.

620 Aluminum-Tungsten Dendrites Test Standard . . .each

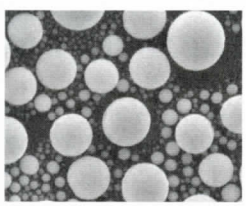
■ Tin on Carbon Disc



Dispersion of tin spheres, the majority being within the size range of 10nm to 40nm, on a carbon substrate. Ideal for astigmatism correction and resolution determination. Recommended for SEM in the semiconductor industry where gold on carbon cannot be tolerated. This standard is available in two forms and can be attached to the surface of any kind of specimen mount; specify the mount type, or as "unmounted".

622 Tin on Carbon Disc, Unmounted . . . . . .each
622-A Tin on Carbon Disc, Mount A . . . . . .each
622-B Tin on Carbon Disc, Mount B . . . . . .each
622-C Tin on Carbon Disc, Mount C . . . . . .each
622-D Tin on Carbon Disc, Mount D . . . . . .each
622-E Tin on Carbon Disc, Mount E . . . . . .each
622-F Tin on Carbon Disc, Mount F . . . . . .each
622-G Tin on Carbon Disc, you supply mount . . . . .each
622-K Tin on Carbon Disc, Mount K . . . . . .each
622-L Tin on Carbon Disc, Mount L . . . . . .each
622-M Tin on Carbon Disc, Mount M . . . . . .each
622-O Tin on Carbon Disc, Mount O . . . . . .each
622-P Tin on Carbon Disc, Mount P . . . . . .each

■ Tin on Carbon Substrate

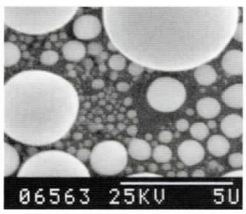


Tin dispersed on the surface of a carbon substrate supported by a tabbed slot grid (slot size 0.4 x 2mm), with a useful range of around 3 - 60nm. Tin spheres are easy to locate on the side of the slot. The comparative thinness of the supporting grid allows for your specimen and the tin sphere standard to be at the same level.

636 Tin on Carbon Substrate, Unmounted . . . . . .each
636-A Tin on Carbon Substrate, Mount A . . . . . .each
636-B Tin on Carbon Substrate, Mount B . . . . . .each
636-C Tin on Carbon Substrate, Mount C . . . . . .each
636-D Tin on Carbon Substrate, Mount D . . . . . .each
636-E Tin on Carbon Substrate, Mount E . . . . . .each
636-F Tin on Carbon Substrate, Mount F . . . . . .each
636-G Tin on Carbon Substrate, you supply mount . .each
636-K Tin on Carbon Substrate, Mount K . . . . . .each
636-L Tin on Carbon Substrate, Mount L . . . . . .each
636-M Tin on Carbon Substrate, Mount M . . . . . .each
636-O Tin on Carbon Substrate, Mount O . . . . . .each
636-P Tin on Carbon Substrate, Mount P . . . . . .each

SEM Low Magnification Resolution Test Specimens

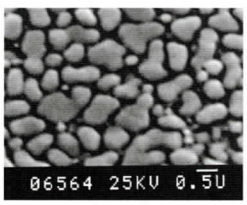
■ Tin Spheres on Carbon



The round tin spheres are particularly useful for testing image quality, distortion, contrast and brightness and probe size. Within size range 1-10µm, for Light Microscopy and Scanning Electron Microscopy. Magnification range approx. 250 - 5,000x.

600 Tin on Carbon, Unmounted. Note: This is shipped on an A Mount, attached with temporary adhesive . . . . . .each
600-A Tin on Carbon, Mount A . . . . . .each
600-B Tin on Carbon, Mount B . . . . . .each
600-C Tin on Carbon, Mount C . . . . . .each
600-D Tin on Carbon, Mount D . . . . . .each
600-E Tin on Carbon, Mount E . . . . . .each
600-F Tin on Carbon, Mount F . . . . . .each
600-G Tin on Carbon, you supply mount . . . . . .each
600-K Tin on Carbon, Mount K . . . . . .each
600-L Tin on Carbon, Mount L . . . . . .each
600-M Tin on Carbon, Mount M . . . . . .each
600-O Tin on Carbon, Mount O . . . . . .each
600-P Tin on Carbon, Mount P . . . . . .each

■ Gold on Carbon



The larger gold particles, with clear separation, provide an excellent structure to set up the microscope. Particle size range 0.1-1µm, for scanning electron microscopes and high magnification light microscopes. Magnification range 800-10,000x.

623 Gold on Carbon, Unmounted . . . . . .each
623-A Gold on Carbon, Mount A . . . . . .each
623-B Gold on Carbon, Mount B . . . . . .each
623-C Gold on Carbon, Mount C . . . . . .each
623-D Gold on Carbon, Mount D . . . . . .each
623-E Gold on Carbon, Mount E . . . . . .each
623-F Gold on Carbon, Mount F . . . . . .each
623-G Gold on Carbon, you supply mount . . . . . .each
623-K Gold on Carbon, Mount K . . . . . .each
623-L Gold on Carbon, Mount L . . . . . .each
623-M Gold on Carbon, Mount M . . . . . .each
623-O Gold on Carbon, Mount O . . . . . .each
623-P Gold on Carbon, Mount P . . . . . .each

See Mount Selections, A-P on page 31

MetroChip Microscope Calibration Target

for SEM, AFM and Light Microscopy

The MetroChip Microscope Calibration Standard for SEM, AFM, Light Microscopy and Metrology Systems provides an extensive range of targets with periodic features for enhanced calibration down to the 100nm range. The MetroChip standard is produced with today's nanotechnology demands in mind. It is designed for a long life use and presents a stable calibration platform. The standard is produced on a 20x20mm chip with a thickness of 750µm. It delivers high contrast images for analytical SEM with minimal charging and combines a huge calibration range from 4mm down to 100nm.

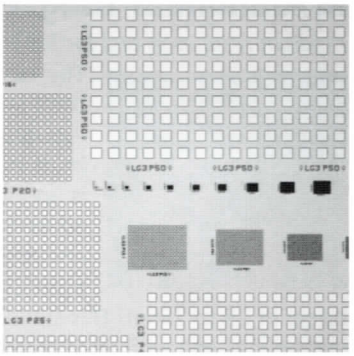
Target calibration for SEM features include alignment marks, linear microscale, distortion measurements, par-axial calibration (image shift), resolution measurements, focus star, stigmator calibration, gratings, concentric circles and squares. The combination of these targets on one standard makes the MetroChip ideal as an all-in-one standard for setting up and regular calibration checks of the SEM or FESEM. It is also employed for Light Microscopy and AFM; there are a number of targets to check linearity, distortion and scan length. T

The MetroChip Calibration Target is fully traceable to NIST Certification:

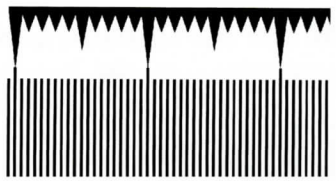
- Certification: Traceability of Sample Pitch (PDF linked from web page)
- Report of Calibration NIST Test No. 821/271639-05 (PDF linked from web page)
- Suitable for light microscopy, SEM, AFM and other metrology systems
- Large range of calibration, from a 4mm ruler down to 100nm geometrics
- Large array of features in both positive and negative structures
- 150nm feature depth with 90° wall angles
- Ease of navigation with dimension labels on most features
- High contrast images in Analytical SEM
- Minimal Charging
- Long Sample Life
- Sample size is 20 x 20mm
- Sample thickness is approximately 750 microns
- The finished product has patterns of etched polycrystalline silicon over a thin oxide on silicon substrate
- Polysilicon thickness is 150nm ±10%
- Oxide thickness under the polysilicon features is less than 5nm, typically 2.5 to 3nm

Complete overview and ordering information on next page

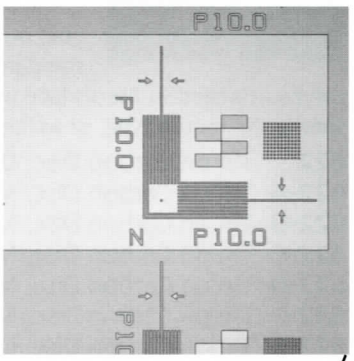
T= Tech Note on web page



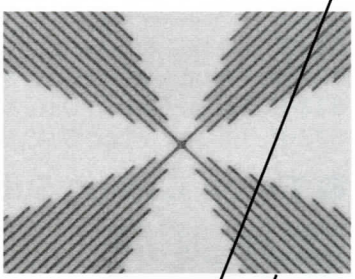
LG1



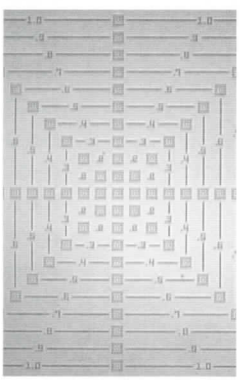
3mm Ruler



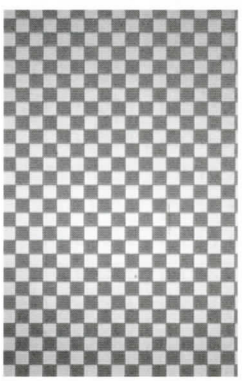
H/V Dense Lines



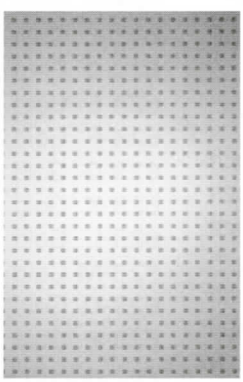
MetroMark (center)



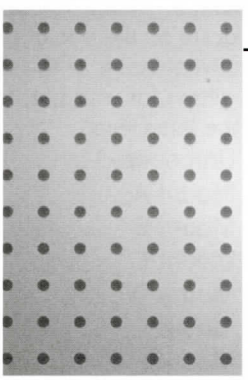
An Overlay Target



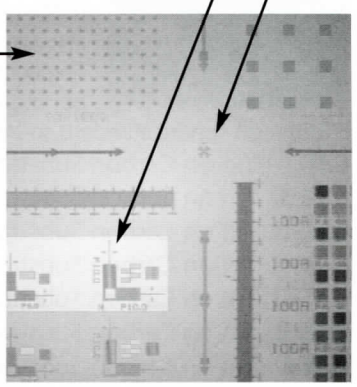
Checkerboard (A)



Sea of Squares (I)



Array of Disks (H)

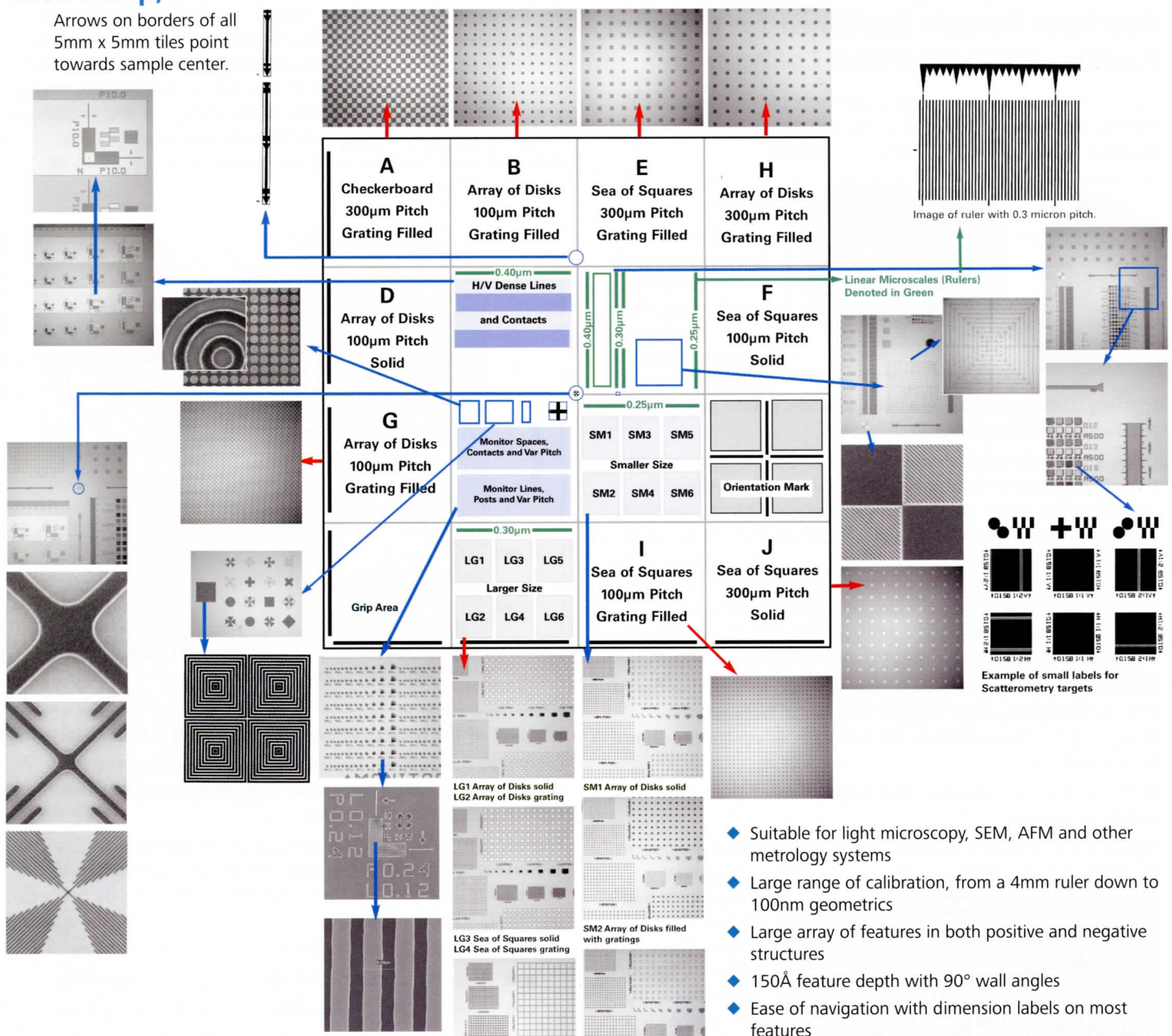


MetroChip Center

MetroChip, *continued*

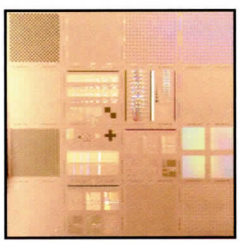
www.tedpella.com/metro_html/metrochip.htm

Arrows on borders of all 5mm x 5mm tiles point towards sample center.



- Sample size is 20 x 20mm
- Sample thickness is 750µm, approximately
- The finished product has patterns of etched poly-crystalline silicon over a thin oxide on a silicon substrate
- Polysilicon thickness is 150nm ±10%
- Oxide thickness under the polysilicon features is less than 50nm, typically 2.5 to 3nm

- Suitable for light microscopy, SEM, AFM and other metrology systems
- Large range of calibration, from a 4mm ruler down to 100nm geometrics
- Large array of features in both positive and negative structures
- 150Å feature depth with 90° wall angles
- Ease of navigation with dimension labels on most features
- High contrast images in Analytical SEM
- Minimal charging
- Long sample life

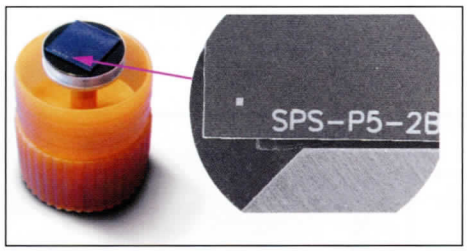


Ordering Information

632 MetroChip Microscope Calibration Target . . . . .each

Forensic Test Specimen
Synthetic Particle Specimen for Gunshot Residue (GSR) SEM/EDX Calibration

This Gunshot Residue Standard is also suitable for use as a calibration and validation sample in the field of analytical Scanning Electron Microscopy (SEM/EDX) investigations.



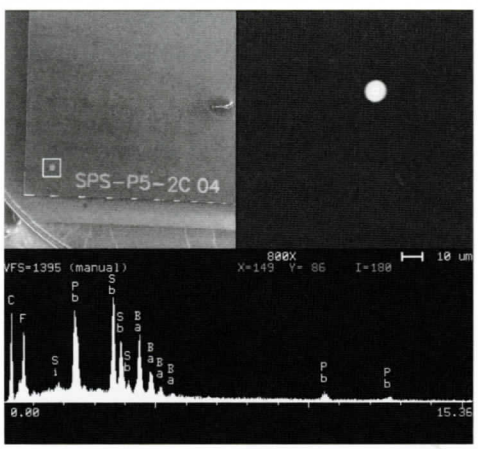
The SPS-P5-2 is specially designed for the adjustment, calibration and validation of analytical SEM/EDX systems when used for automated analysis of GSR particles. It is specially suitable for quick system validation checks and quality assurance procedures.

Using a special process, Pb/Sb/Ba particles are precipitated onto the surface of an 8mm x 8mm silicon chip which is previously applied with a 10µm polyimide layer. The particles are randomly distributed but at known locations. There are four distinct particle sizes of approximately 0.5µm, 0.8µm, 1.2µm and 2.4µm in diameter. In addition the samples are provided with three 10µm particles in order to facilitate a simple data cross-checking of performed automated particle analysis. The GSR Standard is carbon coated to avoid or minimize charging effects.

It is recommended that the BSE signal is used for imaging the particles as this gives a high contrast differential between the Pb/Sb/Ba particles and the silicon substrate. Beam current should not exceed 2 nA.

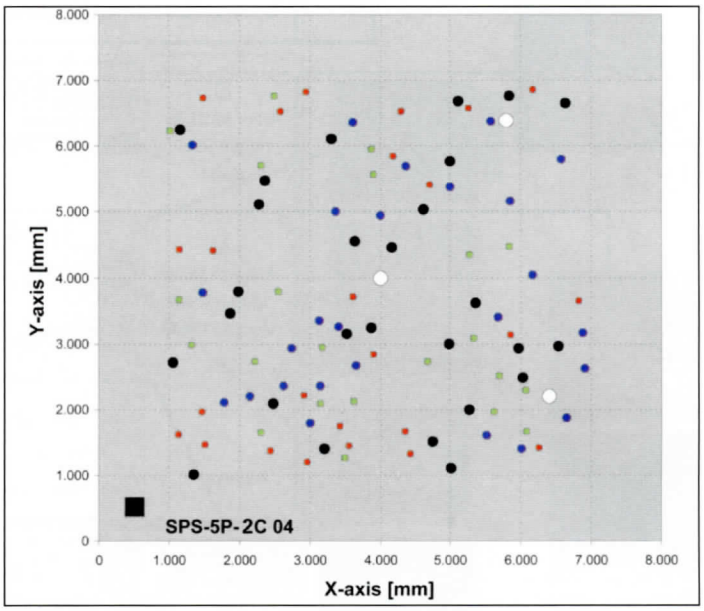
Note on the performance and evaluation of the automated particle analysis.

The automated particle analysis has to be performed at least on the 7mm x 7mm center area on the silicon chip. In general a magnification of 200 to 300x will suffice. There is a 100µm x 100µm Pb/Sb/Ba control pad on the chip that can be used to adjust the BSE signal to the required level for analysis. It is recommended to introduce the specimen into the system in such a way that the PB/Sb/Ba pad is displayed in the lower left corner of the BSE image. (see figure, above)



To perform an automated run on the detection of PB/Sb/Ba particles it is necessary to create a particle class containing the elements Pb, Sb and Ba. Because of the production process, the elements carbon and oxygen (from the protective layer) and silicon and fluorine (from the substrate and the production process), respectively, may also appear.

For the evaluation of the automated search it is recommended that the data obtained from the detected Pb/Sb/Ba particles (in particular their X/Y coordinates and their diameter) is displayed as an X/Y plot (e.g. with EXCEL). When using an appropriate display area, a direct comparison can be made of the size and position of the detected particles with the true values by overlaying the achieved results and the attached particle map (e.g. using an overhead film copy).



X/Y plot of the local distribution of the synthetic GSR particles.

Every GSR standard is supplied with a map showing the exact position of the Pb/Sb/Ba particles as they were precipitated on the surface of the silicon substrate.

Preparing an X/Y plot of the position of the detected particles and overlaying this plot with the map, allows easy comparison of the obtained results with the "real" numbers of Pb / Sb / Ba particles on the standard.

- white: 3 positioned Pb / Sb / Ba 10µm particles
- black: 27 positioned Pb / Sb / Ba 2.4µm particles
- blue: 26 positioned Pb / Sb / Ba 1.2µm particles
- red: 25 positioned Pb / Sb / Ba 0.8µm particles
- green: 22 positioned Pb / Sb / Ba 0.5µm particles

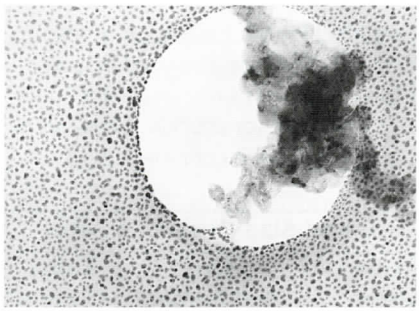
As the exact position of each of the PB/Sb/Ba particles is known, it is easy to evaluate the number of correctly detected particles and find explanations for missed or multiple-detected particles.

See our web page for Gunshot Residue (GSR) Control Standard for Validation and Quality-Assurance Purposes (PDF):
www.tedpella.com/calibrat_html/gunshot.htm

60806-4 SPS-5P-2 GSR Standard on 12.7mm stub (type A mount); 0.5, 0.8, 1.2, 2.4, and 10µm, certified . . . . . .each

Transmission Electron Microscopy and STEM Test Specimens and Calibration Standards

■ Combined TEM Test Specimen

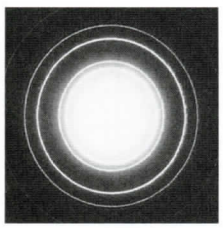


A holey carbon film is shadowed with gold and graphitized carbon particles are deposited. These particles viewed over the holes may be used for assessment of factors limiting the microscope performance. The evaporated gold forms small polycrystalline islands and within these islands lattice fringes can be resolved.

This specimen is also used for contamination measurement rates in the TEM by noting the deposition rate of carbon within the holes found in the gold film. T

638 Combined TEM Test Specimen on 3mm grid . . .each

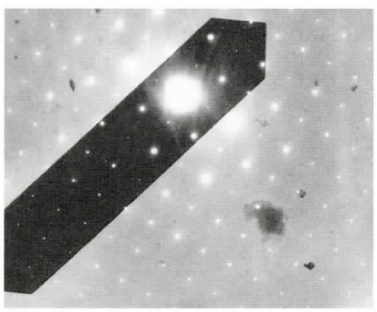
■ Diffraction Standard Camera Length



The nominal value of the effective camera length of a TEM operating in the selected area mode is not sufficiently accurate for calculations of lattice spacing. The actual value of camera length must be calibrated at the same accelerating voltage and objective lens setting by reference to a known substance with well defined diffraction spacings. A normal specimen is evaporated film of aluminum. Very small crystallite size yields ring patterns suitable for calibration. The specimen is supplied with a list of the principal lattice spacings. T

619 Evaporated Aluminum on 3mm grid . . . . . .each

■ Image Rotation Molybdenum Trioxide

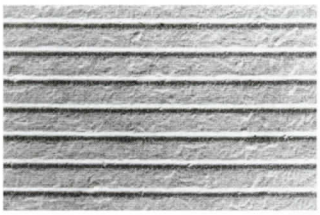


When changing from a selected area image of a specimen to a diffraction pattern, the strength of the intermediate lens is changed, producing an image rotation between the image and the diffraction pattern. This rotation is seen by photographing a crystal whose shape gives a clear indication of orientation. A molybdenum trioxide crystal is suitable for this purpose. T

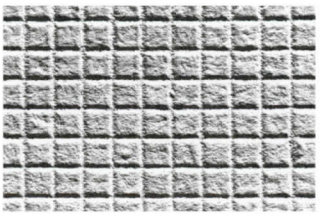
625 Molybdenum Trioxide, on 3mm grid . . . . . .each

T = Tech Note on web page

■ Magnification Calibration, Diffraction Grating Replicas



606



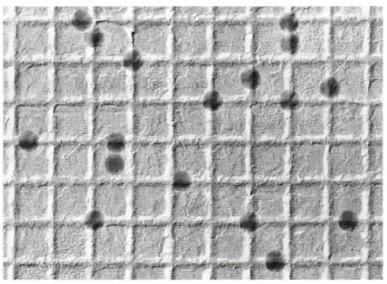
607

Shadowcast carbon replicas of diffraction line gratings, parallel line, waffle pattern gratings and waffle pattern gratings with latex spheres are offered. Typically, parallel is used up to ~40-50,000x, while the waffle is used up to ~80-100,000x. Parallel line gratings are 2,160 lines/mm (54,864 lines/inch). The waffle is 2,160 lines/mm in both directions. Line or "d" spacing for parallel line grating is 462.9nm. Instructions included.

606 Grating Replica, Parallel, 2160 l/mm, on 3mm grid T . . . . . .each

607 Grating Replica, Waffle, 2160 l/mm, on 3mm grid T . . . . . .each

■ Diffraction Grating Replica with Latex Spheres

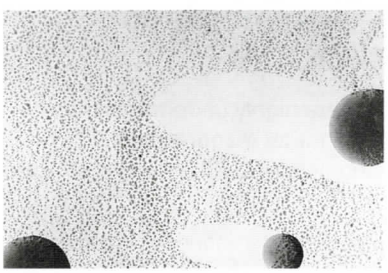


magnification calibration specimen

Two-in-one; this standard for calibration provides a double-check of the accuracy of magnification calibration. It is particularly useful at higher magnification. The latex sphere size is 0.261 µm and the grating replica is 2160 lines/mm. Supplied on 3mm grid. T

603 Diffraction Grating Replica and Latex Calibration Standard . . . . . .each

■ Gold Shadowed Latex

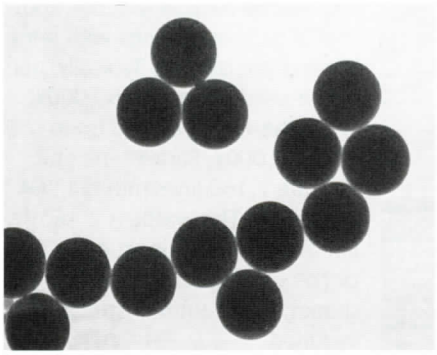


These are latex particles of 0.204µm diameter shadowed with a fairly heavy coating of gold. The gold forms islands of strongly scattering material and produces a suitable test object for STEM. T

628-B Gold Shadowed Latex, 3.05mm grid . . . . . .each

TEM, STEM Magnification and Resolution Test Specimens

■ Polystyrene Latex Spheres



Used as a magnification test specimen in TEM and SEM, but is also employed in particle counting devices as a size check and focus aid. Covers µm to nm range. Offered in a 10ml size, at 0.1% solids content. Specific gravity is 1.05 g/ml. M

Actual size will appear on product label.

Sphere Size and Size Deviation Table		
Prod. No.	**Nom Size (µm)**	**Size Uniformity (µm)**
610-03	0.03	≤18%
610-08	0.08	≤15%
610-10	0.09	≤5%
610-14	0.17	≤3%
610-17	0.26	≤3%
610-20	0.30	≤3%
610-30	0.49	≤3%
610-38	1.00	≤3%

610-03 Latex Spheres, 0.03µm, nom 10ml
610-08 Latex Spheres, 0.08µm, nom 10ml
610-10 Latex Spheres, 0.09µm, nom 10ml
610-14 Latex Spheres, 0.17µm, nom 10ml
610-17 Latex Spheres, 0.26µm, nom 10ml
610-20 Latex Spheres, 0.30µm, nom 10ml
610-30 Latex Spheres, 0.49µm, nom 10ml
610-38 Latex Spheres, 1.00µm, nom 10ml

Set of Latex Spheres: 0.09, 0.03 and 0.48µm mean diameters

610-SET Latex Spheres, set of 3 . . . . . .3x10ml

■ Certified Particle Size Polystyrene - Nanosphere Size Standards

These Nanosphere Size Standards are highly uniform polystyrene spheres calibrated in billionths of a meter (nanometers) with NIST traceable methodology. One nanometer is 0.001 micrometer (µm) or 10 Angstrom units.

Nanosphere Size Standards are packaged as aqueous suspensions in 15 milliliter (ml) dropper-tipped bottles. The concentrations are optimized for ease of dispersion and colloidal stability.
The spheres have a density of 1.05 g/cm3 and a refractive index of 1.59 @ 589nm (23°C).

Methods used to calibrate the diameter of the Nanospheres include adaptions of photon correlation spectroscopy (PCS) and transmission electron microscopy (TEM). PCS uses scattered laser light to correlate the diameter of suspended particles with their Brownian motion. PCS is also referred to as quasi-elastic light scattering or dynamic light scattering.

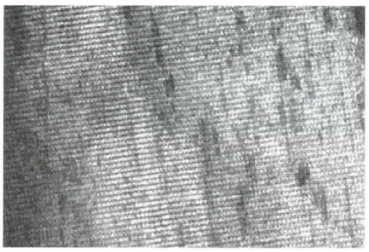
Nanopshere Size Standards are ideal for the calibration of electron and atomic force microscopes. They are also used in laser light-scattering studies and colloidal systems research. The 20 to 900nm range of diameters is convenient for checking the sizes of bacteria, viruses, ribosomes and sub-cellular components. M

Example of Sphere Size and Size Deviation Table				
Prod. No.	**Nominal Diameter**	**Certified Mean Diameter**	**Size Distribution Std Dev. & C.V.**	**Solids Content**
610-50	20nm	21nm ≤1.5nm	not determined	1%
610-53	50nm	50nm ≤2.0nm	6.7nm (13.4%)	1%
610-56	80nm	81nm ≤2.7nm	5.8nm (7.2%)	1%
610-58	100nm	102nm ≤3nm	4.4nm (4.3%)	1%
610-60	150nm	152nm ≤5nm	3.2nm (2.1%)	1%
610-61	200nm	199nm ≤6nm	3.4nm (1.7%)	1%
610-63	240nm	240nm ≤6nm	3.7nm (1.5%)	1%
610-66	350nm	350nm ≤7nm	4.7nm (1.3%)	1%
610-69	500nm	491nm ≤4nm	6.3nm (1.3%)	1%
610-73	600nm	596nm ≤6nm	7.7nm (1.3%)	1%
610-76	900nm	903nm ≤9nm	9.3nm (1.0%)	1%

610-50 Certified Latex Spheres, 20nm 15ml
610-53 Certified Latex Spheres, 50nm 15ml
610-56 Certified Latex Spheres, 80nm 15ml
610-58 Certified Latex Spheres, 100nm 15ml
610-60 Certified Latex Spheres, 150nm 15ml
610-61 Certified Latex Spheres, 200nm 15ml
610-63 Certified Latex Spheres, 240nm 15ml
610-66 Certified Latex Spheres, 350nm 15ml
610-69 Certified Latex Spheres, 500nm 15ml
610-73 Certified Latex Spheres, 600nm 15ml
610-76 Certified Latex Spheres, 900nm 15ml

Note: M= MSDS on web page

■ Catalase Crystals



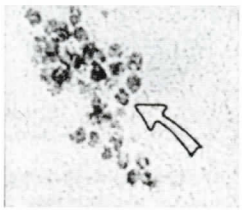
Catalase crystals, negatively stained, are mounted on a grid. They display very clear lattice plane spacings in the TEM and STEM of 8.75nm and 6.85nm. Ⓣ

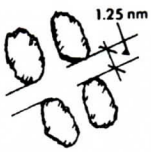
Wrigley, J, (1968). Ultrastructure Res, 24, 454.

Valuable for high magnification calibration.

612 Catalase Crystals, on 3mm grid . . . . . .each

■ Ferritin

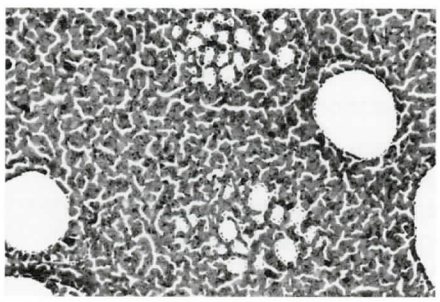




Resolution of the tetrad of this molecule indicates an instrument resolution better than 1.25nm. The ferritin is dispersed on a formvar/carbon substrate supported by a copper mesh grid. Ⓣ

608 Ferritin on 3mm grid . . . . . .each

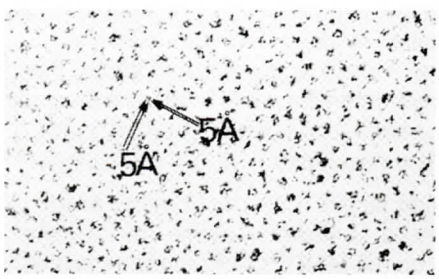
■ Gold on "Holey" Carbon Film



The spaces formed between "islands" of evaporated gold are ideal for checking TEM/STEM (3mm grid) resolution. The holes allow for simultaneous astigmatism correction.

613 Gold on Holey Carbon Film . . . . . .each

■ Evaporated Platinum / Iridium



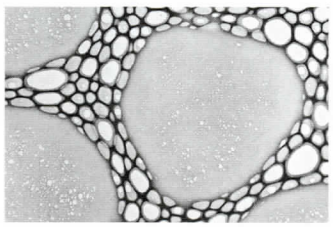
Evaporated Pt/Ir on perforated holey carbon film. Support film provides holes for ease of focus and astigmatism correction. The grains of evaporated metal provide dense particles for TEM resolution checks by the particle separation test. Ⓣ

611 Evaporated Platinum / Iridium; 3mm grid . . . . .each

TEM, STEM Astigmatism Correction

■ "Holey" (Perforated) Carbon Film

best general TEM astigmatism check



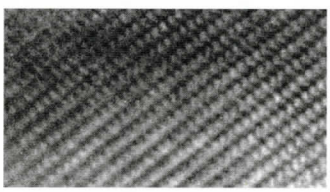
Thin films of carbon which have been treated to obtain a large number of small holes. Examination of the Fresnel fringe around the hole when the objective lens is slightly defocused enables astigmatism to be corrected. Observation of the fringe also gives an indication of TEM stability and available resolution. Ⓣ

609 Holey Carbon Film on 3mm grid . . . . . .each

Lattice Plane Resolution Checks for Transmission Electron Microscopy

■ Lattice Plane Resolution Checks

plane spacing 0.9nm and 0.45nm

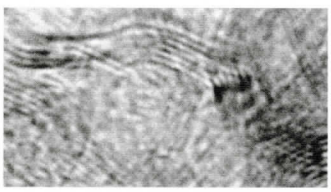


Crystal lattice plane spacings are a good test of microscope stability, and provide an internal standard of magnification.

Asbestos crocidolite. The 0.9nm spacing (020) will be found along the axis of the asbestos fibers. The 0.45nm spacing (021) appears at an angle of about 60° in suitable crystal orientations. To help prevent contamination of the EM or work area with asbestos fibers, these specimens are made using a substrate sandwich technique; the asbestos is layered between a carbon and Formvar film. Ⓣ

624 Asbestos (crocidolite) crystals, 3mm grid . . . . .each

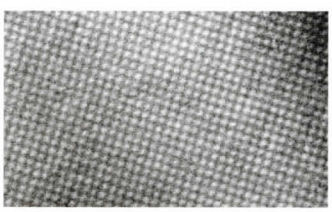
■ Plane Spacing 0.34nm



Graphitized Carbon Black

645 Graphitized Carbon Black on 3mm grid . . . . . .each

■ Plane Spacing 0.204nm, 0.143nm and 0.102nm

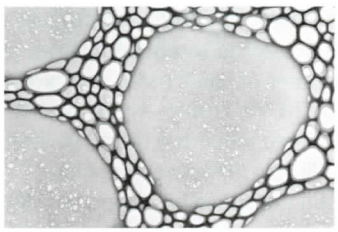


Oriented Gold Crystal

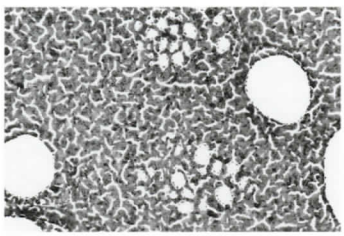
646 Oriented Gold Crystal on 3mm grid . . . .each

Ⓣ= Tech Note on web page

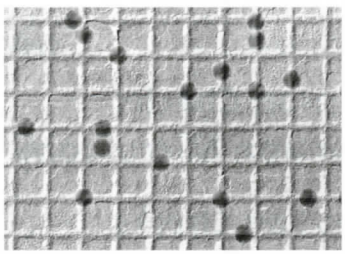
■ Transmission Electron Microscopy Calibration Test Kit, set A and B and High Resolution Multi-specimen



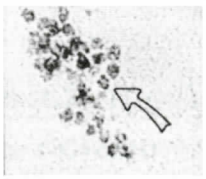
609

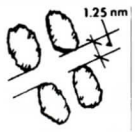


613

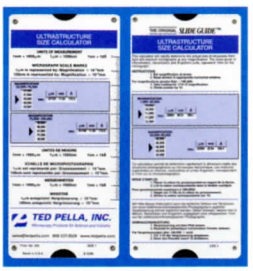


603





608



250

A complete collection of the specimens and measuring aids required for basic TEM calibration and alignment.

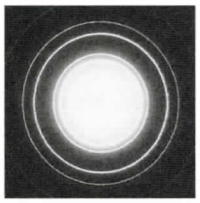
670-A PELCO® TEM Calibration Kit, Set A

Items Included in Set A	Use
609 Holey Carbon Film	Astigmatism Correction
613 Gold on Holey Carbon Film	Resolution Determination
608 Ferritin	Optimum Resolution Determination
603 Latex Sphere on Grating Replica	Magnification Calibration
250 Ultrastructure Size Calculator	Ultrastructure Size Calculation

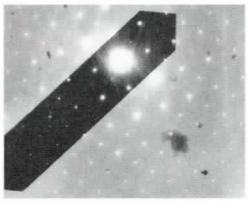
670-A PELCO® TEM Calibration Kit, Set A . . . . . .each

Set B includes all of the specimens and Ultrastructure Size Calculator in Set A plus the following additional specimens for calibration of the diffraction mode.

Additional Items Included in Set B	Use
619 Evaporated Aluminum	Camera Length
625 Molybdenum Trioxide	Image Rotation



619

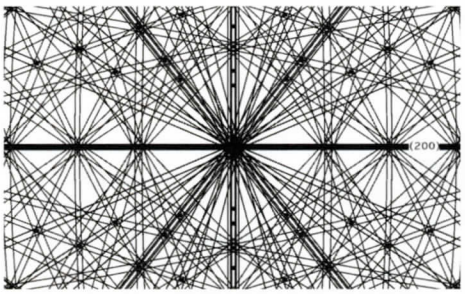


625

670-B PELCO® TEM Calibration Kit, Set B . . . . . .each

■ MAG*I*CAL®

Traceable Transmission Electron Microscopy Calibration Standard



Kikuchi pattern of single crystal silicon viewed down the <011> zone axis. The broad band in the center of this figure is between the [200] Kikuchi lines.

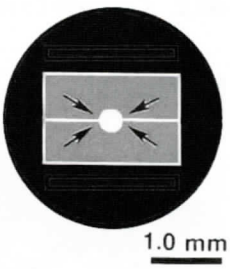


Diagram of the MAG*I*CAL® grid. The arrows point to the four regions containing the calibration marks.

This standard is directly traceable to the crystal lattice constant of silicon and performs all major instrument calibrations for Transmission Electron Microscopy:

- All TEM magnification ranges
- Camera constant
- Image/diffraction pattern rotation

MAG*I*CAL® consists of an electron transparent cross-sectional TEM sample made from an MBE grown, single-crystal semiconductor wafer. When the calibration structure is viewed in a TEM, it appears as a series of light and dark layers where the layer thicknesses are accurately known.

The calibration thickness measurements of the light (silicon) and dark (SiGe alloy) layers are based on careful TEM measurements of the <1 1 1> lattice spacing of silicon, which is visible on the calibration sample itself and are supported by X-ray diffraction measurements.

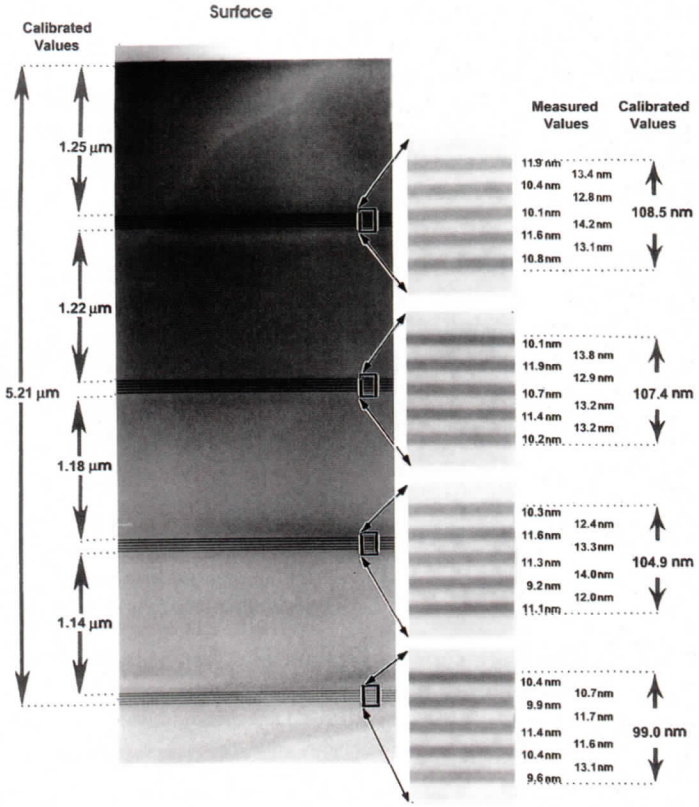
The layer spacings are designed so the sample can be used to calibrate the entire magnification range in TEM from 1,000X to 1,000,000X. As the sample is also a single crystal of silicon, the calibrations requiring electron diffraction information, such as the camera constant and image/diffraction pattern rotation, can also be performed easily and unambiguously.

The MAG*I*CAL® calibration sample is directly traceable to the lattice constant of silicon <1 1 1> (0.3135428nm). This constant can be measured directly on the MAG*I*CAL® sample, providing unbroken traceability to a fundamental constant of nature. One single calibration sample can be used to provide all three of the major TEM instrument calibrations at all magnifications and all camera lengths.

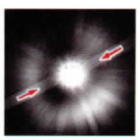
continued on next page

MAG*I*CAL® *continued*

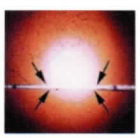
Layer Thickness Values
Calibrated Values = ± 2% Surface



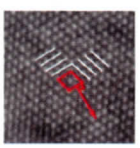
To improve accuracy when making measurements, always measure the largest distance clearly visible on the micrograph. For example, at the highest magnification ranges, measure the distance across the entire set of five dark layers and four light layers, instead of trying to measure an individual dark layer.



A Kikuchi pattern from the single crystal sample which can be used to align the sample.



An optical micrograph of the colors of silicon when it is thinned down to TEM thicknesses, the 1 mm central perforation, and the four areas containing the calibration markings (arrows).



A lattice image of the single crystal silicon sample. The silicon <1 1 1> lattice planes should be measured perpendicular to the planes, in the direction of the arrow.

675 MAG*I*CAL® Calibration Standard . . . . . .each

UHV-EL Reference Standards for EDS/WDS

Ultra High Vacuum Compatible
Micro and Macro Analysis
Standard for Surface and X-ray Analysis

- UHV (ultrahigh vacuum) compatible (10^{-10} torr)
- Suitable for spectral and intensity references for EDS, WDS, EPMA, Auger, XPS, ESCA, etc.
- Custom and standard reference material configurations
- Rectangular or circular retainers holding from 6 to 37 reference standards
- Retainers machined from SS304
- Custom mounting bases available
- Each reference standard is individually and separately prepared from bulk or powdered materials, polished with the most suitable method, and can easily be removed or reinserted into the retainer.

Reference standards supplied with the UHV-EL, which contain only UHV compatible materials, can be used to characterize the transmission of the electron energy analyzer, determine peak shapes, resolution, energies and sensitivity factors.

Since generalized sensitivity factors cannot be used with a reasonable degree of accuracy, even for the same instrument model, it is necessary for these factors to be determined for each unique instrument, on a continuing basis. Conditions will change over time because of peak shift, amplifier settings and spectrometer tolerances.

Design

The retainer is precision machined by numerically controlled tools from stainless steel 304. The round UHV-EL-37 is laser engraved to assist in locating the desired reference standard using electron or optical imaging. All reference standards are precisely referenced within 0.13mm of the top surface. This recess protects the reference standard surfaces from contamination and scratching and also minimizes the possibility of X-ray fluorescence from the retainer. The reference standards, which are of various thicknesses, are retained by SS304 clips which are inserted from the bottom of the mount.

continued on next page

UHV-EL Reference Standards for EDS/WDS *continued*

Reference standards are individually sized and polished according to the properties of the material. Cross contamination and smearing are avoided.

If a reference standard surface gets roughened from excessive ion beam sputtering or is too highly oxidized, it can be easily removed and replaced in your laboratory. Tools and clips are provided. If bulk materials are not available for some reference standards, powders are used. They are consolidated with silver flake and the powder grains metallographically polished. Many insulators prepared this way are sufficiently conductive for X-ray and Auger analysis without carbon coating. The silver can be used for reference when determining sensitivity factors.

Custom Preparation

Your materials may be inserted into one of the retainers described using careful techniques. Electron beam X-ray techniques and reference standards - which are charge sensitive - can be carbon coated.

Shipping

UHV-EL-37 circular retainer reference standards are shipped in a VACU-STORR container (maintains vacuum for years). It is optional for other configurations or custom orders.

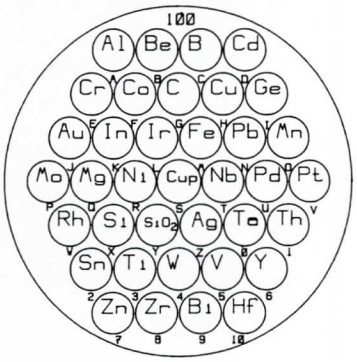
Retainers

For configuration, designate Retainer Style and Element/Compound locations and numbers:
Use and submit the form on our web page:
www.tedpella.com/calibrat_html/uhv-el.htm
or print out the PDF form and fill in the numbers in the actual spaces for the desired elements/compounds and fax it to us at: 530-243-3761.See below for a list of elements and compounds and their respective order numbers.

Round UHV-EL Retainer can be ordered in standard or custom configuration

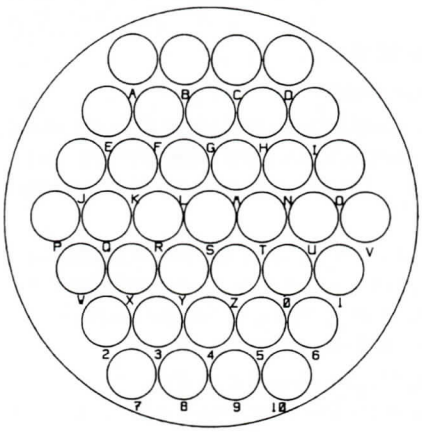
The standard configuration is shown here.

A custom configuration requires that details be given regarding the elements chosen and their location on the retainer.



25mm diameter, Standard Configuration for Round Retainer

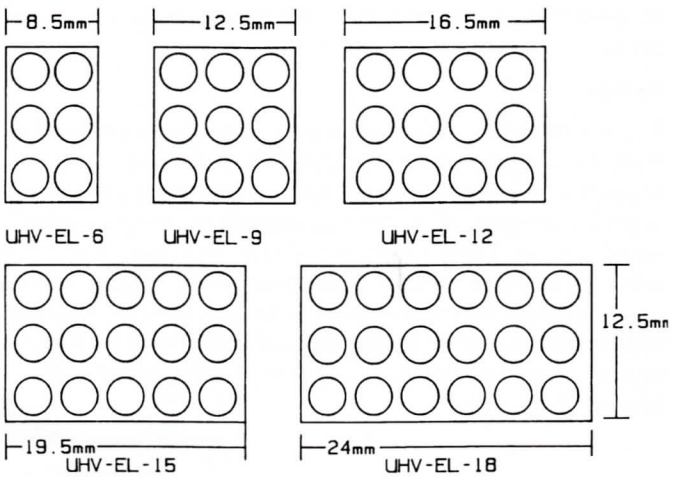
Make a copy and enter element/compound number from our list in an appropriate spot on retainer and fax: 530-243-3761 or use the easy submit form on our web site linked from: www.tedpella.com/calibrat_html/uhv-el.htm



UHV-EL-37

For Our Information:

Instrument Manufacturer _____
Model _____
Technique (AES, XPS, etc.) _____
RM Requested (UHV-EL-?) _____
Carbon Coat Insulators? _____
Your Name _____
Copmpany _____
Department _____
Address _____
City _____ State _____ Zip _____
Phone _____ FAX _____



UHV-EL Retainers Without Standards

6065 UHV-EL Rectangular Retainer, 8.5 x 12.5mm, 6 spaces . . . . . .each

6066 UHV-EL Square Retainer, 12.5 x 12.5mm, 9 spaces . . . . . .each

6067 UHV-EL Rectangular Retainer, 16.5 x 12.5mm, 12 spaces . . . . . .each

6068 UHV-EL Rectangular Retainer, 19.5 x 12.5mm, 15 spaces . . . . . .each

6069 UHV-EL Rectangular Retainer, 24 x 12.5mm, 18 spaces . . . . . .each

continued on next page

UHV-EL Retainers Without Standards *continued*

6070 UHV-EL Round Retainer, 25mm diameter, 37 spaces . . . . . .each

UHV-EL Single Reference Standards (3mm dia.) for Retainers

6060 UHV-EL - Any Single Reference Standard other than Diamond, Cu/Au Ag/Au or Al/Cu (specify number from list) . . . . . .each

6061 Diamond UHV-EL Single Reference Standard, (No. 168 on list) . . . . . .each

6062 Cu/Au UHV-EL Single Reference Standard, SRM482, 5 wires (No. 197 on list) . . . . . .each

6063 Al/Cu UHV-EL Single Reference Standard (No. 230 on list) . . . . . .each

6091 Ag/Au UHV-EL Single Reference Standard, SRM 481, 6 wires (No. 197A on list) . . . . . .each

6064 Faraday Cup for UHV-EL to measure beam current . . . . . .each

UHV-EL Retainers Complete with Reference Standards

6075 UHV-EL Rectangular Retainer, 8.5 x 12.5mm, with 6 Reference Standards (select from list) . . . . . .each

6076 UHV-EL Square Retainer,12.5 x 12.5mm, with 9 Reference Standards (select from list) . . . . . .each

6077 UHV-EL Rectangular Retainer, 16.5 x 12.5mm, with 12 Reference Standards (select from list) . . . . .each

6078 UHV-EL Rectangular Retainer, 19.5 x 12.5mm, with 15 Reference Standards (select from list) . . . . .each

6079 UHV-EL Rectangular Retainer,24 x 12.5mm, with 18 Reference Standards (select from list) . . . . .each

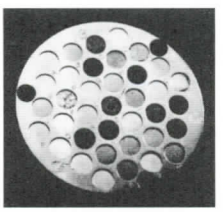
6080 UHV-EL Round Retainer, 25mm diameter, with 37 Reference Standards (select from list) . . . . .each

6081 UHV-EL Round Retainer, 25mm diameter, Standard Configuration with 37 Reference Standards (see previous page) . . . . . .each

Reference Standards for UHV-EL Retainers

Abbreviations

M .....natural mineral
Opt.....optical crystal
P .....powder: mixed with either Ag or Sn (for S containing materials)
TF.....thin film on silicon wafer
VD.....vapor deposit (CVD, LPCVD, etc.)
B .....bulk material
C .....crystalline
EM .....end member mineral
F.....foil
HP .....hot pressed
"+" .....higher purity



*Purity "N" is the # of "9"'s. 5N stands for 99.999% pure, 2N5 is 99.5% pure

Element/Compound Reference Standard list

Standard		Symbol	Form	*Purity
1.	Aluminum	Al	F	3N
1A.	Aluminum Carbide	Al_4C_3	P	4N
2.	Aluminum Fluoride	AlF_3	P	2N5
3.	Aluminum Oxide	Al_2O_3	C	3N
4.	Aluminum Nitride	AlN	P	2N+
5.	Antimony	Sb	B	2N
6.	Barium Fluoride	BaF_2	C	2N+
7.	Barium Sulfate	$BaSO_4$	P	3N
8.	Barium Titanate	$BaTi_4O_9$	HP	2N5
9.	Barium Titanate	$BaTiO_3$	P	5N
10.	Beryllium	Be	F	3N
11.	Bismuth	Bi	B	2N8
12.	Bismuth Oxide	Bi_2O_3	P	3N
12A.	Bismuth Telluride	Bi_2Te_3	B	2N
13.	Boron	B	P	1N75
14.	Boron Carbide	B_4C	P	5N
15.	Boron Nitride	BN	B	4N
16.	Boron Phosphide	BP	P	3N
17.	Cadmium	Cd	F	Opt
17A.	Cadmium Sulfide	CdS	P	3N
18.	Calcium Carbonate	$CaCO_3$	C	3N+
19.	Calcium Fluoride	CaF_2	C	3N
20.	Carbon (Pyrolytic)	C	CVD	5N
21.	Carbon (Diamond)	C	C	4N7
22.	Cerium Oxide	CeO_2	P	2N5
23.	Cesium Iodide	CsI	O	2N
23A.	Cesium Bromide	CsBr	P	3N
24.	Chromium	Cr	P	4N6
24A.	Chromium Carbide	Cr_3C_2	P	2N5
25.	Chromium Nitride	Cr_2N	P	2N5
26.	Chromium Oxide	Cr_2O_3	HP	5N
27.	Cobalt	Co	F	5N
28.	Cobalt Oxide	Co_3O_4	P	3N
29.	Cobalt Silicide	$CoSi_2$	P	2N
30.	Copper	Cu	F	2N
31.	Cupric Oxide	CuO	P	3N
32.	Cuprous Oxide	Cu_2O	EM	3N
33.	Copper Sulfide	CuS	M	2N
34.	Copper Sulfide	Cu_2S	M	2N+
35.	Dysprosium	Dy	F	4N
36.	Erbium	Er	F	5N
37.	Europium Oxide	Eu_2O_3	HP	3N
38.	Gadolinium	Gd	F	5N
39.	Gallium Arsenide	GaAs	C	5N
40.	Gallium Nitride	GaN	P	3N
41.	Gallium Phosphide	GaP	P	2N5
42.	Gallium Antimonide	GaSb	P	2N5
43.	Germanium	Ge	B	2N
44.	Germanium Oxide	GeO	P	2N5
45.	Gold	Au	F	3N
46.	Hafnium	HF	F	3N
46A.	Hafnium Boride	HfB_2	P	4N7
47.	Hafnium Carbide	HfC	B	6N
47A.	Hafnium Nitride	HfN	P	2N5
47B.	Hafnium Oxide	HfO_2	P	3N
48.	Holmium	Ho	B	3N
49.	Indium	In	F	3N
50.	Indium Arsenide	InAs	C	?
51.	Indium Phoshide	InP	C	5N
52.	Indium Antimonide	InSb	P	3N
52A.	Indium Tin Oxide 10% In homogenous	ITO	P	3N
53.	Iridium	Ir	F	3N
54.	Iron	Fe	P	3N
54A.	Iron Carbide	Fe_3C	F	3N
55.	Iron Fluoride	FeF_2	F	3N
56.	Iron Fluoride	FeF_3	P	3N
57.	Iron Nitride	Fe_3N	P	2N5
58.	Iron Oxide	FeO	P	3N
59.	Iron Oxide	Fe_2O_3	P	5N
60.	Iron Oxide	Fe_3O_4	EM	5N
61.	Iron Phosphide	FeP	EM	3N
62.	Iron Sulfide	FeS_2	P	3N
63.	Lead	Pb	P	Opt
64.	Lead Oxide	PbO	F	2N8
65.	Lead Sulfide	PbS	P	Opt
66.	Lanthanum Hexaboride	LaB_6	P	3N5
67.	Lanthanum Oxide	La_2O_3	C	3N
68.	Lithium Fluoride	LiF	P	4N
69.	Magnesium	Mg	C	3N
70.	Magnesium Fluoride	MgF_2	F	3N
71.	Magnesium Oxide	MgO	C	4N
72.	Manganese	Mn	C	3N
73.	Manganese Sulfide	MnS	B	2N5
74.	Manganese Oxide	MnO_2	P	?
75.	Mercury Sulfide	HgS	P	4N5
75A.	Mercury Iodide	HgI_2	P	2N+
76.	Molybdenum	Mo	C	4N
77.	Molybdenum Carbide	Mo_2C	F	4N8
78.	Molybdenum Silicide	$MoSi_2$	HP	3N
79.	Molybdenum Oxide	MoO_3	P	2N5
81.	Osmium	Os	P	2N
81A.	Neodymium Fluoride	NdF_2	F	3N

continued on next page

Element/Compound Reference Standard list *continued*

Standard	Symbol	Form	*Purity
81B. Neodymium	Nd	P	2N8
82. Nickel	Ni	C	2N5
82A. Nickel Aluminide	NiAl	F	Opt
83. Nickel Oxide	NiO	F	3N5
84. Nickel Phosphide	Ni_2P	P	3N
85. Nickel Silicide	$NiSi_2$	P	3N
86. Niobium	Nb	P	Opt
87. Niobium Carbide	NbC	P	2N5
88. Niobium Oxide	Nb_2O_5	HP	4N
89. Palladium	Pd	P	3N
90. Platinum	Pt	F	4N
91. Potassium Bromide	KBr	F	4N
92. Potassium Chloride	KCl	C	3N5
93. Potassium Iodide	KI	C	3N
93A. Praeseodymium Fluoride	PrF_3	C	3N8
94. Rhenium	Re	HP	3N
95. Rhenium Oxide	ReO_3	F	3N
96. Rhodium	Rh	P	3N
97. Rubidium Chloride	RbCl	F	3N
97A. Rubidium Iodide	RbI	P	2N7
98. Ruthenium	Ru	P	2N8
99. Samarium	Sm	P	3N5
100. Scandium	Sc	F	4N8
101. Selenium	Se	C	3N
102. Silicon	Si	C	Opt
103. Silicon Carbide	SiC	CVD	Opt
104. Silicon Dioxide	SiO_2	EM	2N5

Standard	Symbol	Form	*Purity
105. 1000Å/Silicon	SiO_2	TF	3N5
106. Silicon Nitride	Si_3N_4	HP	2N
107. 468Å/Silicon	Si_3N_4	TF	2N5
108. Silver	Ag	F	3N5
109. Silver Chloride	AgCl	C	5N
109A. Silver Oxide	Ag_2O	P	3N
110. Silver Sulfide	Ag_2S	C	?
111. Sodium Chloride	NaCl	C	2N5
112. Sodium Fluoride	NaF	C	5N
113. Strontium Fluoride	SrF_2	P	3N
113A. Strontium Oxide	SrO	P	2N5
114. Tantalum	Ta	F	3N
115. Tantalum Carbide	TaC	HP	3N
116. Tanlalum Nitride	TaN	P	4N8
117. Tantalum Oxide	Ta_2O_5	P	1N8
118. Tantalum Oxide	Ta_2O_5	TF	2N8
119. 1000Å/Ta			2N5
120. Tantalum Silicide	$TaSi_2$	P	2N5
121. Tellurium	Te	B	2N
122. Terbium	Tb	F	2N5
123. Thallium Chloride	TlCl	P	3NB
124. Thorium Oxide	ThO_2	P	2N5
125. Thulium	Tm	F	2N5
126. Tin	Sn	F	2N5
127. Tin Oxide	SnO_2	EM	2N5
128. Titanium	Ti	F	2N7
128A. Titanium Al Carbide	Ti_2AlC	HP	2N5
129. Titanium Carbide	TiC	HP	2N5

Standard	Symbol	Form	*Purity
130. Titanium Diboride	TiB_2	HP	2N5
131. Titanium Dioxide	TiO_2	EM	2N5
132. Titanium Nitride	TiN	P	4N5
132A. Titanium Oxide	TiO	HP	3N
133. Titanium Silicide	$TiSi_2$	P	3N
134. Tungsten	W	F	4N
135. Tungsten Carbide	WC	HP	4N8
136. Tungsten Nitride	WN	P	3N
137. Tungsten Oxide	WO_3	P	2N+
138. Tungsten Silicide	WSi_2	P	Opt
139. Uranium 238 (Note: partially oxidized)	U	F	4N
140. Vanadium	V	F	2N5
141. Vanadium Carbide	VC	HP	4N
141A. Vanadium Nitride	VN	HP	2N5
142. Vanadium Oxide	V_2O_5	P	4N
142A. Ytterbium	Yb	F	3N
143. Yttrium	Y	F	3N
143A. Yag	YAlO	C	?
144. Yttrium Oxide	Y_2O_3	P	4N
145. Zinc	Zn	F	4N8
146. Zinc Oxide	ZnO	HP	?
147. Zinc Selenide	ZnSe	C	?
148. Zinc Sulfide	ZnS	C	?
149. Zirconium	Zr	F	2N8
150. Zirconium Carbide	ZrC	HP	?
150A. Zirconium Nitride	ZrN	P	2N5
151. Zirconium Oxide	ZrO_2	C	2N7

Mineral	Formula (Approximate)
152. Acanthite	Ag_2S
153. Albite	$NaAlSi_3O_8$
154. Almandine	$Fe_3+2Al_2(SiO_4)_3$
155. Andradite	$Ca_3Fe_2+3(SiO_4)_3$
156. Anorthite	$CaAl_2Si_2O_8$
157. Barite	$BaSO_4$
158. Benitoite	$BaTiSi_3O_9$
159. Biotite (black mica)	$K(Mg,Fe^{+2})_3(Al,Fe^{+3})$ - $Si_3O_{10}(OH,F)_2$
160. Bytownite	$(Na,Ca)Al(Al,Si)Si_2O_8$
161. Calcium Carbonate	$CaCO_3$
162. Cassiterite	SnO_2

Mineral	Formula (Approximate)
163. Chalcocite	Cu_2S
164. Cinnabar	HgS
165. Chrysoberyl	$BeAl_2O_4$
166. Covellite	CuS
167. Cuprite	Cu_2O
168. Diamond (added cost)	C (cleaved ~1mm)
169. Diopside	$CaMgSi_2O_6$
170. Dolomite	$CaMg(CO_3)_2$
170A. Fayalite	$Fe_2{}^{2}+SiO_4$
171. Fluorapatite	$Ca_5(PO_4)_3F$
172. Forsterite	Mg_2SiO_4
173. Hematite	Fe_2O_3

Mineral	Formula (Approximate)
174. Hornblende (Amphibole)	$Ca_2(Mg,Fe^{+2})_4$ - $Al(Si7Al)O_{22}(OH,F)_2$
175. Kyanite	$Al_2O_3 \cdot SiO_2$
176. Magnetite	Fe_3O_4
177. Orthoclase	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$
178. Quartz	SiO_2
179. Rutile	TiO_2
180. Sodalite	$Na_4(AlCl)Al_2(SiO_4)_3$
181. Spinel	$MgAl_2O_4$
182. Willemite (Troosite)	Zn_2SiO_4
183. Wollastonite	$CaSiO_3$

SRM# National Institute of Standards & Technology (NIST, formerly NBS). Please see note below regarding alloys.

Glasses	B_2O_3	Na_2O	MgO	Al_2O_3	SiO_2	Cl	K_2O	CaO	TiO_2	$V2O_5$	Cr_2O_3	MnO_2	Fe_2O_3	ZrO_2	PbO	Bi_2O_3	BaO	ZnO	CoO	CuO
184. 612		14.0		2.0	72.0			12.0		+50 ppm of 51 other elements										
185. 93a	12.5	3.9		2.2	80.8	.06	.01	.01	.01				.028	.04						
186. K252					40.0							5.0					35.0	10.0	5.0	5.0
187. K229					30.0										70.0					
188. K326	30.0	2.0	30.1		29.9			8.0												
189. K309				15.0	40.0			15.0					15.0				15.0			

Ti Alloys	Fe	C	Mn	P	S	Si	Cu	Zn	Pb	Sn	Ni	Cr	V	Mo	Ti	As	W	Zr	Nb	Ta	Al	Co
190. 654b	.23					.045	.004			.023	.028	.025	4.31	.013	88.05			.008			6.34	
191. 1128	.134	.011								3.04		2.96	15.13		75.64						3.06	
Miscellaneous NIST Standards																						
192. 1104	.088			.005			61.33	35.31	2.77	.43	.07											
193. 1108	.004		.0025				64.9	34.4	0.06	.39	.033											
194. 1110	.033						84.5	15.2	0.03	.051	.053											
195. 1230	Bal	.044	.64	.023	.0007	.43	.14				24.2	14.8	.23	1.18	2.12						.24	.15
195A. 1243	.79l	.024	.019	.003	.0018	.018	.007				58.78	19.20	.12	4.25	3.06			.053			1.23	12.46
196. C2402	7.3	.01	.64	.007	.018	.85	.19				51.5	16.15	.22	17.1			4.29					1.5

197. SRM-482 5 wires in one 3mm Ø mount. Cu:Au (20:80, 40:60, 60:40, 80:20) + pure Cu. (added cost)

197A. SRM-481 6 wires on 3mm mount.

Steels	Fe	C	Mn	P	S	Si	Cu	Zn	Pb	Sn	Ni	Cr	V	Mo	Ti	As	W	Zr	Nb	Ta	Al	Co
198. 461	Bal	.15	.36	.053	.019	.047	.34		.003	.022	1.73	.13	.024	.3	.01	.028	.01	<.005	.011	.002	.005	.26
199. 462	Bal	.40	.94	.045	.019	.28	.20		.006	.066	.70	.74	.058	.08	.037	.046	.053	.063	.096	.036	.02	.10
200. 464	Bal	.54	1.32	.017	.021	.48	.094		.02	.043	.13	.078	.29	.029	.004	.018	.022	.01	.037	.069	.005	.02
201. 465	Bal	.037	.032	.008	.01	.029	.019		<.0005	.001	.026	.004	.002	.005	.20	.01	.001	.002	.001	.001	.19	.03
202. 466	Bal	.065	.11	.012	.009	.025	.033		.001	.005	.051	.011	.007	.011	.057	.014	.006	<.005	.005	.002	.01	.04
203. 467	Bal	.11	.23	.033	.009	.26	.067		.00	.1	.088	.036	.041	.021	.26	.14	.20	.094	.29	.23	.16	.07
204. 468	Bal	.26	.47	.023	.02	.075	.26		<.0005	.009	1.03	.54	.17	.20	.011	.008	.077	<.005	.006	.005	.04	.16
205. 661	Bal	.39	.66	.015	.015	.223	.042			.01	1.99	.69	.011	.19	.02	.017	.01	.009	.22	.02	.02	.03
206. 663	Bal	.57	1.50	.02	.005	.7	.09		.0022		.32	1.31	.31	.30	.05	.01	.04	.05	.049		.24	.05
207. 664	Bal	.87	.25	.01	.025	.066	.25		.024		.14	.06	.10	.49	.23	.05	.10	.069	.15	.11		.15
208. 665	Bal	.008	.0057	.002	.0059	.008	.0058				.041	.007	.0006	.005	.0006	.002						.01
209. 1761	Bal	1.03	.68	.043	.033	.19																
210. 1762	Bal	.034	2.03	.036	.03	.36																
211. 1763	Bal	.20	1.59	.012	.022	.65																
212. 1764	Bal	.59	1.22	.023	.012	.06																
213. 1765	Bal	.006	.14	.007	.004	.005																
214. 1766	Bal	.015	.06	.004	.002	.01																
215. 1767	Bal	.051	.02	.005	.009	.02																
216. 1768	Bal	.001	.014	.0013	.0003		.0006				.0014										.002	.002

Alloys- Certified by a group of laboratories, NIST traceable. Analysis provided with each alloy purchased.

Stainless Steels + High Temp

217. AISI 303
218. AISI 304
219. AISI 316
220. AISI 321
221. AISI 410
222. AISI 440C
223. PH13-8MO
224. 15-5 PH
225. 17-4PH
226. CARP 20CB3
227. Maraging 300
228. HK-40

Low Alloy + Specialty Alloys

233. C-4140
234. C-4340
235. C-8620
236. Tool Steel A-6
237. Tool Steel D-2
238. Tool Steel H-13
239. Tool Steel M-2
240. 2-Cr-1Mo (36a)
241. 9Cr-1Mo (38a)

Nickel / Cobalt

224. Inco 600
243. Inco 625
244. Inco 718
245. Inco 800
246. Hastoloy C-22
247. Hastoloy C-276
248. Hastoloy X

Copper / Brass / Bronze

249. CDA 360
250. CDA 510
251. CDA 655
252. CDA 857

Miscellaneous Standards (not traceable):

229. BPSG (not an NIST standard), 4% P, 3.3% B.
230. Al-Cu: NIST traceable standard for energy dispersive x-ray detector calibration. (added cost)
231. C-Cu-Ag: Standard for electron backscattering adjustment. Used for gun shot residue calibration
232. GSR- Gun shot residue: mixture of Ba, Sb, Pb particles in epoxy and carbon coated.

Faraday Cup, for beam current measurement, is available for all of the retainers and will take one of the spaces.

PLEASE READ CAREFULLY!

The metal alloys on this list cannot be assumed to be homogenous at the micrometer scale. If you intend to use ZAF corrections electron beam excited x-ray analysis (wavelength or energy dispersive), the sample volume must be homogenous within the electron excited volume. It is a misuse to use these metal alloys for bulk quantitative analyses. Nevertheless, they are useful for comparison purposes (in a least square sense) to compare against unknown materials. Every effort is made to insure that cutting, grinding, and polishing of the materials do not alter their composition.

Form OP3.0-1/2 Rev. C

TEM CHECKER

monitor performance of X-ray detectors in the TEM

Contains 5 manganese discs in a PELCO® grid storage box. Each disc is 3mm in diameter and fits into a sample holder exactly as does a grid. The discs are not transparent to the beam but will give a strong manganese peak to check the resolution of an EDS detector.

602-15 TEM Checker . . . . . .each

X-CHECKER

monitor Energy Dispersive Spectrometer/SEM systems

X-Checker™ is a calibration aid to help you monitor the performance of your EDS X-ray system on an SEM. X-Checker™ contains a series of standard materials on a 1" diameter aluminum base. With X-Checker, you can check your detector resolution and calibration, test for contamination on the detector window, monitor low-end sensitivity, and calibrate your image analysis software. When was the last time you checked the performance of your EDS system?

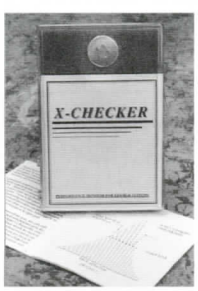
The 602 contains manganese to measure full width at half max detector resolution, aluminum and copper to check spectral calibration, and carbon to monitor calibration at the low end of the spectrum for thin window detectors.

Two nickel TEM grid sizes, 40x40 µm and 18x18µm, with ±5% accuracy, are furnished for checking image analysis software calibration. They also facilitate an easy test for monitoring the amount of vacuum pump oil contamination on the detector window.

Instruction booklet and padded storage case is included. 25mm diameter x 10mm height.

The addition of boron nitride to the 602-2 adds a more sensitive monitor of low end performance on thin window and windowless detectors.

602 X-CHECKER . . . . . .each
602-2 X-CHECKER, B (with Boron Nitride) . . . . . .each



X-CHECKER EXTRA

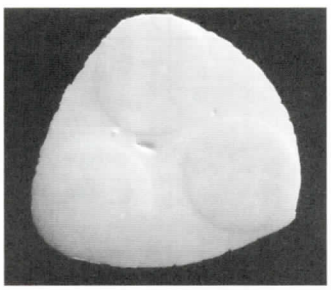
EDS Performance monitor contains the same elements as the 602-2 plus a fluorine source to test resolution at the fluorine K-alpha peak (industry standard for measuring low end resolution). A beryllium grid is also added for ultimate test of low end detector performance.

602 X-CHECKER EXTRA . . . . . .each

Reference Specimens for Back-Scattered Electron Detection Systems

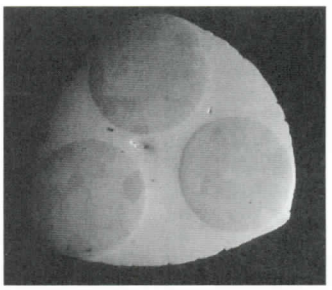
When equipped with a back-scattered electron detector, an electron microscope has the capability to produce images in which the contrast is controlled by differences in atomic number across the specimen.

Electron Micrographs of the gold-platinum back-scattered electron reference specimen.



100µm

S.E. image at low magnification. The platinum wires are visible due to the topographical variations across the specimen surface.



100µm

B.S.E. image at low magnification. The platinum wires are visible due to the atomic number difference between the platinum and gold.

Three reference specimens are now available that are suitable for testing the atomic number contrast performance. Each of the reference specimens consists of two high purity elements that have an atomic number difference of 1. They are in the form of a wire of the low Z element embedded in a matrix of the high Z element.

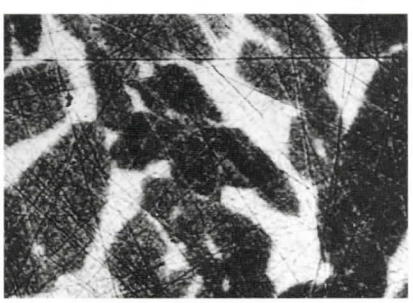
The specimens are available as a single mount either 3mm or 5mm diameter or can be incorporated into a block of standards.

652 BSE Atomic Reference,
Nickel (Z-28) - Copper (Z-29) . . . . . .each

653 BSE Atomic Reference,
Palladium (Z-46) - Silver (Z-47) . . . . . .each

654 BSE Atomic Reference,
Platinum (Z-78) - Gold (Z-79) . . . . . .each

Duplex Reference Specimen

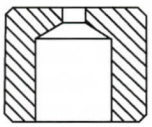


100µm

An alternative and very sensitive test is by means of an alloy with two major copper/zinc phases separated by an atomic number difference of 0.1. The light phase illustrated in the micrograph has a mean atomic number of 29.47 and the dark phase a mean atomic number of 29.37.

655 Duplex Reference Specimen . . . . . .each

PELCO® Faraday Cup



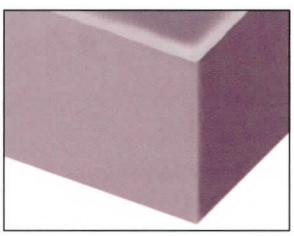
Cross section of Pelco® Faraday Cup

The PELCO® Faraday Cup allows for precise measurement of the beam current on SEM, MicroProbe or FIB systems; select point mode on your system and focus the beam into the small 100µm aperture hole of the PELCO® Faraday Cup. The cavity under the aperture hole absorbs virtually all electrons or ions. Absorption efficiency of the design is 98.5% or better (depending on beam diameter and kV). The PELCO® Faraday Cup is designed for mounting on the specimen stage and uses the existing electrical connections built in the SEM, Microprobe or FIB stage for measuring or displaying absorbed current. If your instrument does not have the capability of measuring and displaying absorbed current, you need to use a Keithley Pico-ammeter.

The PELCO® Faraday Cup is made from brass and overall dimensions are only 2.5mm diameter with 2mm height, and aperture size is 100µm. The compact size allows for easy mounting on specimen holders, standard or mounts. We can also supply the PELCO® Faraday Cup already mounted on a variety of popular SEM mounts. (see mount selections, type A - P on page 31)

651 PELCO® Faraday Cup, Unmounted . . . . . .each
651-A PELCO® Faraday Cup, Mounted A . . . . . .each
651-B PELCO® Faraday Cup, Mounted B . . . . . .each
651-C PELCO® Faraday Cup, Mounted C . . . . . .each
651-D PELCO® Faraday Cup, Mounted D . . . . . .each
651-E PELCO® Faraday Cup, Mounted E . . . . . .each
651-G PELCO® Faraday Cup, Mounted G, you supply mount . . . . . .each
651-K PELCO® Faraday Cup, Mounted K . . . . . .each
651-L PELCO® Faraday Cup, Mounted L . . . . . .each
651-M PELCO® Faraday Cup, Mounted M . . . . . .each
651-O PELCO® Faraday Cup, Mounted O . . . . . .each
651-P PELCO® Faraday Cup, Mounted P . . . . . .each

FIB and Ion Beam Sputter Standards



Ion Sputter Standards manufactured to the highest precision for calibrating sputter ion guns. Thin film of Silicon Dioxide (SiO_2), Silicon Nitride (Si_3N_4),Tantalum Pentoxide ($Ta2O_5$) and Nickel/Chromium (NiCr-3) are available. Uniformity is ~5%.

Silicon Dioxide (SiO_2)

Silicon wafers with thin films of silicon dioxide are available in thicknesses of 20, 32, 120 and 500nm. These oxide films are grown with a wet oxygen process which insures a higher degree of uniformity than available using other processes. The wafers are 4" in diameter.

612-11 Silicon Dioxide Ion Sputter Calibration Standard, SiO_2 (~20nm) on 4" Si wafer . . . . .each
612-12 Silicon Dioxide Ion Sputter Calibration Standard, SiO_2 (~32nm) on 4" Si wafer . . . . .each
612-13 Silicon Dioxide Ion Sputter Calibration Standard, SiO_2 (~120nm) on 4" Si wafer . . . .each
612-14 Silicon Dioxide Ion Sputter Calibration Standard, SiO_2 (~500nm) on 4" Si wafer . . . .each

Silicon Nitride (Si_3N_4)

100nm Silicon Nitride (CVD) films deposited on a ~1 x 3cm piece of silicon wafer.

612-20 Silicon Nitride Ion Sputter Calibration Standard, Si_3N_4 on 1 x 3cm Si . . . . . .each

Tantalum Pentoxide (Ta_2O_5)

Films of tantalum pentoxide (~100nm) are anodically grown on 0.5mm thick tantalum foil. The standards are ~37x37mm. The thickness accuracy is ~5%.

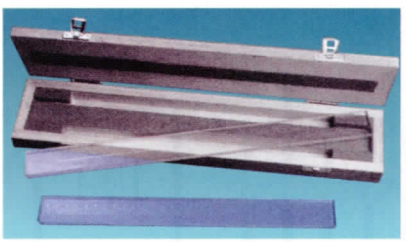
612-30 Tantalum Pentoxide Ion Sputter Calibration Standard, Ta_2O_5 (~100nm) on 37x37mm Ta foil . . . . . .each

Nickel / Chromium (NiCr-3)

Consisting of 12 alternating layers: 6 layers of Cr (~53nm) and 6 layers of Ni (~64nm) for a total thickness of ~700nm with a maximum variation across the 75mm production wafer of ±2%. Standard is on a 1x3cm section of a polished silicon wafer. The mass density of Cr and Ni was measured using electron beam excitation and measuring characteristic x-ray intensities.

612-40 Nickel / Chromium Ion Sputter Calibration Standard, Ni / Cr (12 layers) on 1x3cm Si . . . .each

Light Microscopy Scales and Finder Slides



Linear Glass Scales

for measurement and calibration of instruments and standards

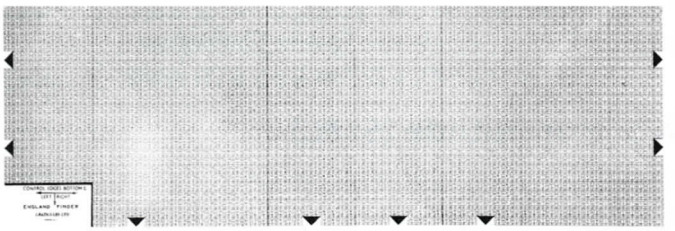
50mm/0.1mm div., 0.03mm line width, accuracy (overall) within 0.002mm:
2280-35 50mm Micrometer Scale, 0.1mm div. . . . .each

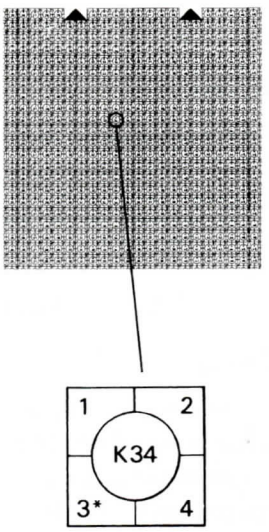
150mm/0.1mm div., 0.03mm line width, accuracy (overall) within 0.015mm:
2280-36 150mm Micrometer Scale,0.1mm div. . . . .each

150mm/1mm div., 0.07mm line width, accuracy (overall) within 0.01mm:
2280-37 150mm Micrometer Scale, 1mm div. . . . .each

England Finder - S7 Slide

locator and calibration slide





X (A through Z, excluding I)
Y (1 through 75), note K34.

The England Finder is a glass slide marked over the top surface in a way that a referenced position can be directly read relative to the locating edges.

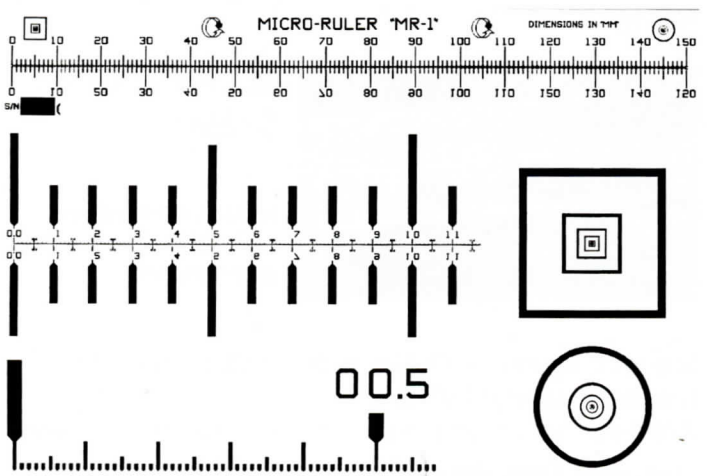
All England Finders produced by Graticules for over 40 years are identical. The purpose of the finder is to give the microscopist an easy method of recording the position of a particular field of interest, so that the same position can be re-located at a later date, or by another person in another laboratory, or when using any other England Finder on any other microscope.

Slide thickness is 1.35mm ±0.05mm. Nominal line width is 0.025mm.

For more information see our web page www.tedpella.com/calibrat_html/calib.htm

2280-50 England Finder S7 Slide . . . . . .each

Ruler MR-1, Traceable



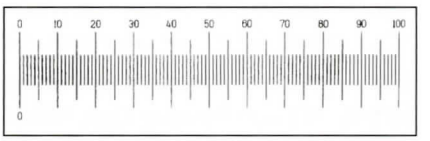
The minimum increment is 0.01mm. Circle diameters and square boxes are: 0.20, 0.05, 0.10, 0.50, 1.00, 2.00 and 5.00mm. Fabricated using semiconductor technology. Material is anti-reflective chromium over soda-lime glass. Overall size is 25 x 180 x 3mm thick. Labeled in mm with an overall scale of +150mm. Accuracy is ± 2µm over 150mm. Forensic scientists place objects to be measured either over the scale or beneath it (scales are written in both right-reading and mirror image so the dimensions appear properly in a photo micrograph).

National Physical Laboratory (NIST counterpart in the UK) Traceable Certified Reference Material. Geller MicroAnalytical Laboratory certification is made under ISO-17025 accreditation.

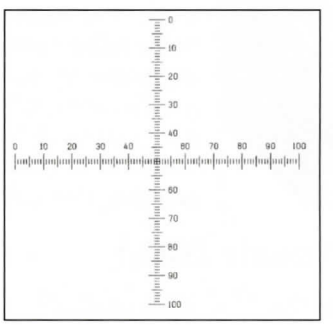
6085 Micro-ruler MR-1, NPL traceable . . . . . .each

Stage Micrometers for Transmitted and Reflected Light

These stage micrometers are intended for routine calibration of light microscopes, particularly when alternating objectives of different microscopes. Ideal for student, lab settings and instructional purposes. Robust construction. Scale is centered on a glass disc, mounted in a black anodized aluminum slide, 75 x 24 x 2mm thick.

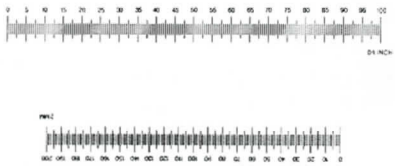


2280-10 Micrometer Scale 10mm in 0.1mm divisions . . . . . .each
2280-11 Micrometer Scale 5mm in 0.05mm divisions . . . . . .each
2280-12 Micrometer Scale 0.1 inch in 0.001 inch divisions . . . . . .each
2280-13 Micrometer Scale 1mm in 0.01mm divisions . . . . . .each
2280-14 Micrometer Scale 0.005 inch in 0.0001 inch divisions . . . . . .each
2280-15 Micrometer Scale 0.1mm in 0.002mm divisions . . . . . .each



2280-16 Crossed Micrometer Scales 1, in 0.01mm division . . . . . .each
2280-17 Micrometer Scale Vertical, 2mm . . . . . .each
2280-18 Micrometer Scale 1mm in 0.01mm divsions, no coverglass . . . . . .each

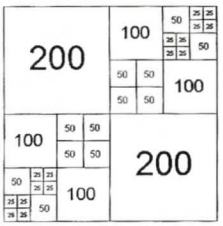
Stage Micrometer Scale



2mm in 0.01mm divisions and 0.1 inch in 0.005 inch divisions.

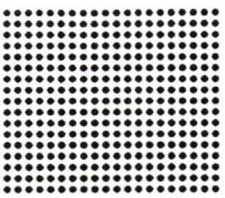
2280-24 Stage Micrometer, metric/inch, 2mm/0.01mm and 0.1"/0.005" . . . . . .each

Image Analysis Standard (Reference Stage Graticule)

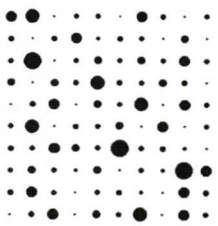


Provides four high precision test areas designed for calibrating image analysis systems and identifying deviations and distortions in optical imaging systems. The standard, which can also be used as a high precision stage micrometer, is supplied with recommendations for its use and an individual certificate of calibration.

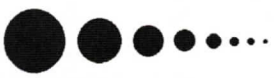
It is produced on a 75mm x 25mm slide and has a square grid accuracy of ±0.1µm and a dot accuracy of ±0.3µm (except for the smallest and largest two dots on the root-2 array where accuracy is ±0.5µm).



The four test areas are:



1. A 400µm x 400µm square grid which is subdivided into 200, 100, 50 and 25µm squares providing a means to detect gross image distortions and can be used as an accurate two dimensional stage micrometer.
2. A 20 x 17 array of nominally 15µm diameter dots can be used to identify lens distortions, i.e. to set the field of view to eliminate edge distortion.



3. A root-2 array of spots from 3µm to 48µm diameter is used for determining the threshold level of cameras and microscope systems.
4. A log-nominal distribution array of 100 spots ranging from 4.5µm to 27µm diameter enables the mean and standard deviation to be determined and compared with the certified values. This is an idealized distribution of maximum dynamic range for a full screen.

Supplied with a Certificate of Calibration from NPL (National Physics Laboratory, counterpart of NIST in the UK.).

Note: NPL is part of the International Metrology Group so that all of its measurements are directly traceable to the International Metre Standard held in Paris, France. This means that the certificate is internationally traceable.

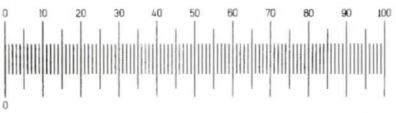
2280-26 Image Analysis Standard Slide . . . . . .each

Grouped Graduation Pattern

For speedy determination of a range of feature sizes within a given specimen.

2280-25 Stage Micrometer Grouped Pattern . . . . . .each

Stage Micrometers for Reflected Light



This scale is etched through highly reflective vacuum coated metal. When viewed with reflected light illumination, as with a metallurgical microscope, the scale appears black against a bright background.

2280-27 Micrometer Scale for Reflected Light, 10mm in 0.1mm divisions . . . . . .each

2269-10 Micrometer Scale for Reflected Light, 1mm in 0.01mm divisions . . . . . .each

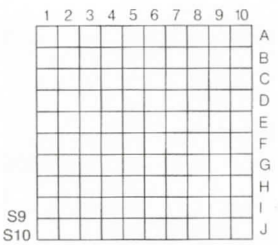
For the previous stage micrometers on this page, certificates are available at the time of purchase:

2280-60 GRATS Certificate done by the manufacturer . . . . . .each

2280-61 UKAS Certificate Traceable to UKAS Standard . . . . . .each

2280-62 NPL Certificate Traceable to NPL (National Physics Laboratory in the UK, counterpart of NIST in the UK.) . . . . . .each

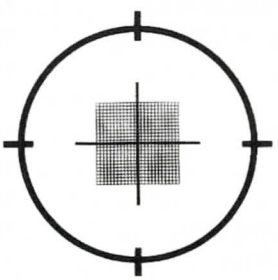
Counting Slides



2280-30 Counting Slide, 1mm Square / 0.1x0.1mm . . . .each

2280-31 Counting Slide, .5mm Square / 0.05x0.05mm . .each

Counting Grids



2280-32 Counting Grid, 0.01mm grid / 0.2x0.2mm overall . . . . . .each

2280-33 Counting Grid, 0.01mm grid / 1.5x1.5mm overall . . . . . .each