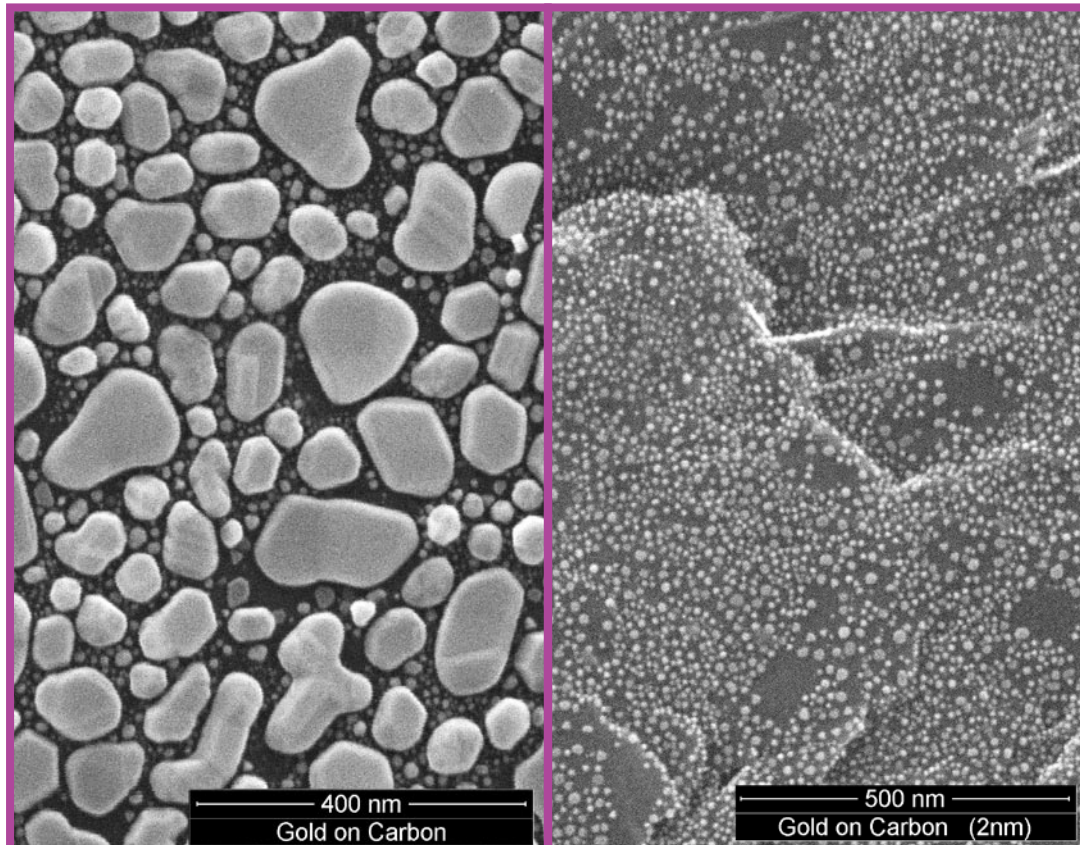


EM RESOLUTIONS
Supporting Electron Microscopy

Gold on Carbon

resolution standards

- get the best from your SEM



SGC5200 Gold on Carbon

Gold islands with diameters 5nm – 200nm on carbon

SGC0230 High-resolution Gold on Carbon

Gold islands with diameters 2nm – 30nm on carbon

Gold on Carbon resolution standards provide a means for testing the resolution of SEMs. The varying sized gaps between gold crystals on a carbon substrate allow tests for resolution to be made under actual operating conditions. They can also be used to assess the quality of grey-level reproduction at high resolution. Gold on Carbon is available from EM Resolutions Ltd in two size ranges; SGC5200 is good for all SEM's and SGC0230 with its ultra small gold islands is best for modern hi-resolution FEGSEMs.

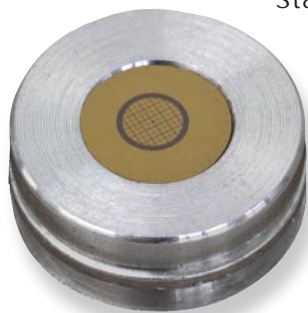
High resolution SEMs should give good results in the gap test combined with good grey level reproduction.

Medium-quality instruments may achieve a chosen gap resolution, but the grey-level production may be quite poor, for example, only 4 or 5 grey levels may appear.

Grey levels arise in secondary electron (SE) mode and originate from geometric irregularities on the test specimen that result in differential signal collection. The angular crystal faces of the larger gold crystals are particularly useful for grey level assessment.

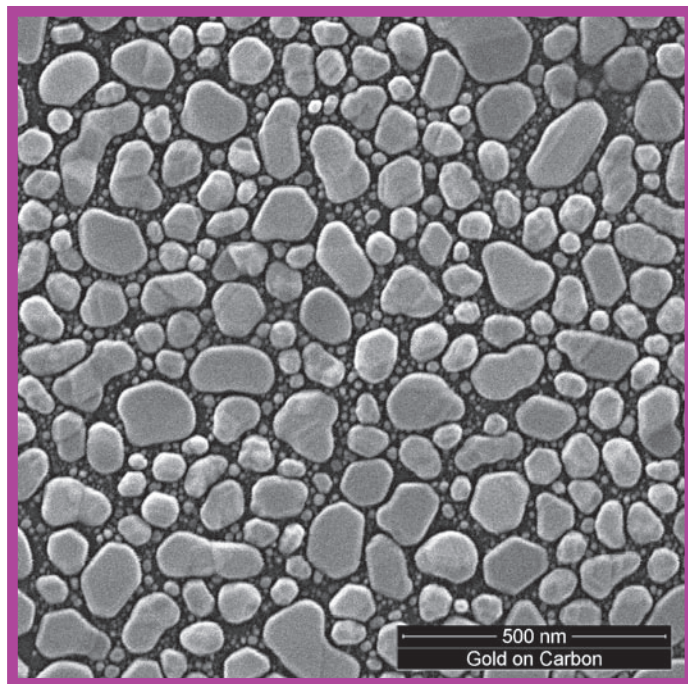
To facilitate preliminary focusing and positioning at low magnifications (<150X) an outline of a square grid is provided on the surface of the

standard. By using known areas within the grid the user can make tests whilst preserving un-irradiated areas for future use.



The particle size is very fine in the boundary region between the gold in the grid squares and uncoated carbon in the grid bars and can be used for a critical assessment of the imaging capabilities of the microscope.

When assessing the secondary electron image quality, the sample is best viewed using a specimen tilt of 30° to the SE detector. The degree of stage tilt used in back-scattered mode will depend on the position of the detector. It is advisable not to use tilt angles greater than 35° as



the larger crystals may shield the small crystals from view.

Caution: When making gap measurements it should be remembered that the magnification is not constant throughout the image when the sample is tilted.

Re-ordering details:

SGC5200 Gold on Carbon and **SGC0230** High-resolution gold on carbon are usually supplied on a 12.5 mm pin stubs.

If you require an unmounted resolution standard please add U after the number. eg **SGC5200U**.

For resolution standards on other stubs please specify.

Instructions for use

1. Setting up the SEM

There are many variables that can affect the final image so recommending exact conditions for SEM resolution and grey level testing is somewhat difficult. For best results the gold islands should be visualised at 40,000X magnification or greater.

As a general guide, the operator should be aiming to use the Gold on Carbon resolution standard at a fairly short working distance of 7 or 8mm. The best probe sizes are available at higher probe energies, so a gun potential of 20kV or above should be chosen for the initial testing. Subsequently it may be of interest to examine the performance of the SEM at lower gun potentials: however, unless the SEM in question has a dedicated facility for high quality imaging at below 10keV, there will not be much point in attempting work at this level.

It is important that the filament is correctly saturated and that the gun is set up for optimum beam brightness and stability. Apertures should be centred and astigmatism and fine focus carefully checked immediately prior to recording the image. For ultimate performance the stage should be mechanically stable, there should be a good chamber vacuum, and the stray field and ambient vibration level in the SEM room should be below the recommended level set by the SEM manufacturer.

For recording, the largest number of scan lines per frame resolvable on the recording screen should be used, and a long recording time is recommended (up to 10 minutes may be available on some instruments) which should ensure a good signal to noise ratio. If the operator is looking for good grey level reproduction, it is very important that the recording camera lens is well focused and image capture is carefully controlled for the best grey range available. Measurements of gaps can of course only be made after magnification calibration of the SEM, and the microscopist must be satisfied that the calibration is rigorously applicable to the micrograph recorded of the Gold on Carbon resolution standard.

2. Suggested Imaging of Gold

Set up the SEM as usual, insert the resolution standard and wait for a good vacuum. Switch on the gun and saturate the filament carefully. Starting at a low magnification (<150X), focus on the edges of the dark grid bars and search for a suitable area of gold. Raise the magnification to 500X and focus on an irregular portion of the gold. Increase the magnification to 40,000X keeping the specimen in focus.

Move the specimen to image an area within a grid square (if the stage is tilted, use X-shift for convenience so that you do not lose focus). Focus carefully on the gold particles. Raise the magnification to 80,000X (or greater) and make final adjustments to the stigmators and the fine-focus controls.

NB. The latter adjustments should be performed quickly if the SEM is prone to contamination deposition. Record the image using a very slow probe scanning rate.

SGC0230 High-resolution Gold on Carbon standards have small size gold particles (<2nm-30nm) particularly suitable for use with Field Emission SEMs and require higher magnification to resolve the smaller particles. These resolution standards should be used in conjunction with the standard gold on carbon standard. The instructions for AGC5200 also apply to these ultra high resolution standards.

