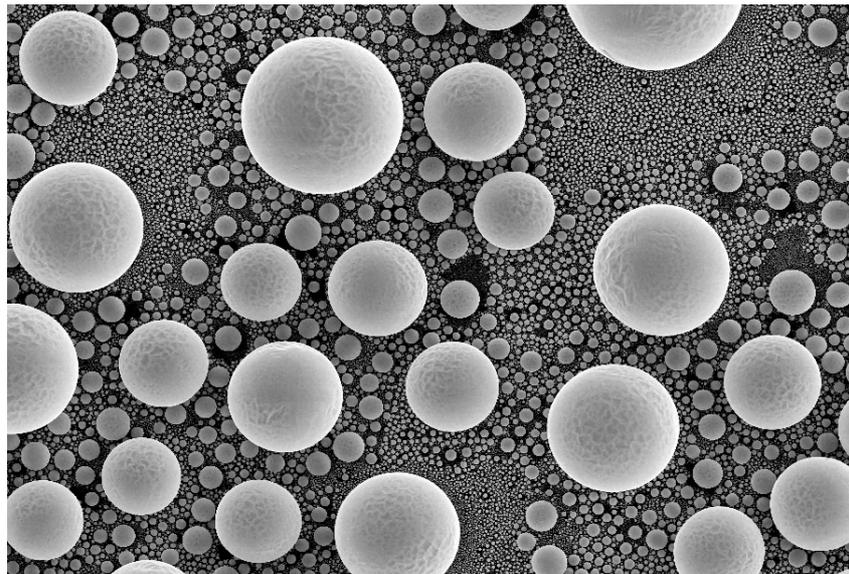


## Universal tin on Carbon Specimen AGS1937, S1937A, S1937 B, S1937 C, S1937 D, S1937 E, S1937 T, S1937 U

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### 1. General

This specimen provides a means of measuring resolution, astigmatism and image shift in scanning electron microscopes using a single specimen. The tin balls vary in size between 5nm – 30µm. This means that unlike some other test specimens, it can be imaged over a wide range of magnification, accelerating voltage and spot size. The relatively high atomic number of tin gives the spheres high contrast when compared to the carbon substrate. The ability to image the specimen at low magnification simplifies initial focussing at low accelerating voltages.

### 2. Using the Specimen

#### 2.1 Resolution testing

The spaces between adjacent spheres are the smallest features on the specimen and can be used for measurement of instrument resolution. The smallest spheres and subsequent gaps between them will be found in the shadow of the largest spheres. If operating at low accelerating voltages the smallest gaps may not be resolved and areas with larger spheres should be selected. Some mechanical rotation and tilting of the specimen may be necessary to ensure that the chosen areas are facing the SED detector. The smallest gap between two spheres that can be resolved, is a measure of the resolution of the SEM at the accelerating voltage and working distance being used.

If the specimen is tilted towards the detector, only measurements made in the horizontal direction will be valid. The true magnification at which measurements are made should be verified by first calibrating the magnification under the conditions being used, using a suitable magnification reference standard.

## 2.2 Astigmatism Correction

The manufacturing process produces near perfect spheres, which are not damaged by the electron beam. Any astigmatism present will result in the spheres appearing distorted. Because they are round it is relatively simple to see distortion and apply the appropriate correction.

The specimen can be used as a periodic check on the state of the electron column by monitoring the amount of correction required to remove the astigmatism. Alternatively if astigmatism on a user specimen cannot be corrected, the tin on carbon specimen can be used to confirm whether the astigmatism is inherent in the column or caused by the specimen itself.

## 2.3 Image Shift

If the electron column has been dismantled or apertures exchanged, some re-alignment may be necessary. The largest tin spheres on the specimen can be used at relatively low magnification to observe image shift with changes in accelerating voltage or spot size. As the alignment is improved, the magnification can be increased and smaller spheres selected for fine adjustment of alignment.