Sample Certificate (non-traceable) for 144nm, 2D calibration standard; #16465-2D thru #16465-2D-R

CERTIFICATION

Serial Number: 3206J0147 **Pitch Period:** 143.8 **nm (+/- 0.5 nm)**
Standard deviation of individual pitch values < 1 nm (measured in 8 µm image, using DiscTrack Plus™. Point to point measurements will be less precise, due to surface and edge roughness).

Instructions

Background Information

Composition: Aluminum posts/bumps on Silicon substrate about 4x3 mm. The pattern covers the entire specimen.
General appearance: the pattern is blue-green.
Bump height: typically more than 80 nm. Note: this is not a step height reference specimen. Height is not specified or certified.
Can be used for SEM and AFM and related scanning probe techniques.

Appearance and usage

Be sure to mount the specimen with the blue-green side up.
There may be a number of visible defects on the surface of this specimen, such as pits, scratches and debris. Defects can help you focus on the surface of the specimen. After focusing, for best results, make images that exclude such defects. See "About Defects' on page 2.

Storage and handling

Store in a dry environment at room temperature or below.
CAUTION:

- Do not touch the surface.
- Do not expose the surface to liquid or vapor of any material that reacts with Aluminum or Silicon

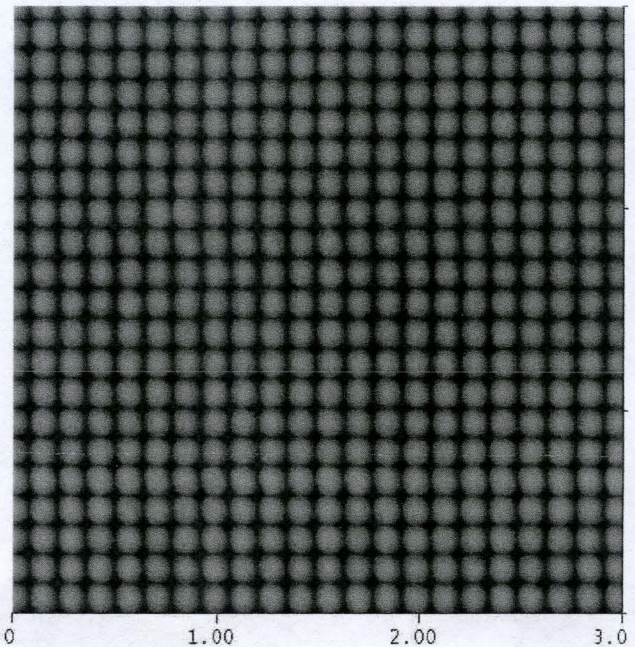
We have not determined whether this specimen can be scanned in liquid.

Cleaning

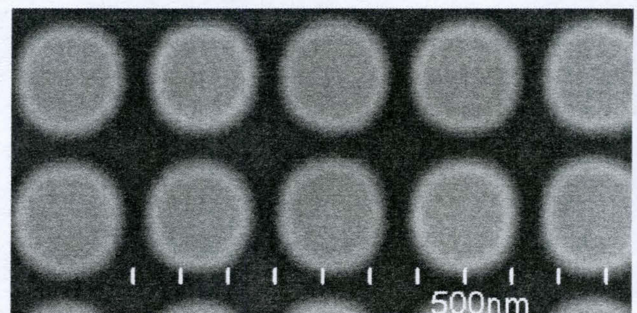
We recommend "do not try to clean the specimen." There is sufficient usable area on the calibration standard to make tens of thousands of measurements without reusing any areas altered or contaminated by previous scans. Therefore, we recommend that you do not attempt to remove any contamination which occurs during normal use. Having said that, we have had good success using CO_2 Snow Cleaning and we can do this for you at our own lab.

Durability

Strict adherence to the storage, handling and cleaning procedures outlined above should preserve the standard for a period of years. However, since we cannot control the conditions of use, neither Advanced Surface Microscopy, Inc. nor its distributors assume any responsibility for damage to this standard by improper handling and storage or by attempts to clean or refurbish it.



3 µm AFM height image



FE-SEM image, 10 kV.

About Defects

We have extensively characterized the visible defects using optical and atomic force microscopy. In general, there are two types of defects: missing and added material. Material is missing when a scratch has removed bumps or when the pattern was not properly developed in a microscopic region. We find that the pattern is perfect up to about 10 μm from the boundary of such areas. Material is added when dust or other debris is on top of the pattern. We find that the pattern is perfect all the way up to the boundary of the debris.

We have also studied the nanometer-scale defects:
-about 1 in 4000 bumps is missing
- for each approximately 8000 bumps there is one extra bump (interstititial) located in the space between normal bumps.
-there are height variations of up to 10 nm.
Color variations visible in the optical microscope at high magnification (200-1000x) and "bull's eye" pattern visible at lower magnification are not defects.

Conclusion: the defects do not reduce the functionality of the product.