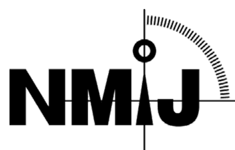
National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 5209-a

No. +++

TaN Dot-array

This certified reference material (CRM) is produced in accordance with the NMIJ's management system and is in compliance with ISO 17034 and ISO/IEC 17025. This CRM is intended for use in the magnification calibration of instruments, and examination of instrument conditions through image sharpness measurement in scanning electron microscopy (SEM).

Certified Values

This CRM consists of a square-lattice TaN dot-array fabricated on a silicon substrate. The dot pitch of the array is certified in both the x and y directions, with the certified values given below. The uncertainty of the certified value is the expanded uncertainty obtained by multiplying the combined standard uncertainty by a coverage factor (k) of 2, and it is the half-width of an interval estimated to have a level of confidence of approximately 95 %.

Substance	CAS No.	Certified value Dot pitch x (nm)	Expanded uncertainty Dot pitch x (nm)	Certified value Dot pitch y (nm)	Expanded uncertainty Dot pitch y (nm)
TaN Dot-array	Si: 7440-21-3 TaN: 12033-62-4	119.6	0.6	119.5	0.6

Analysis

The certified value of this CRM was determined using a scanning electron microscope (SEM). The dot pitch was defined as the average distance between the centroids of adjacent dots in secondary electron images acquired at an accelerating voltage of 3 kV. The value was obtained by evaluating 6600 centroid-to-centroid distances between adjacent dots through SEM image analysis.

Metrological Traceability

The certified values of this CRM were obtained using an SEM instrument whose magnification was calibrated with a micro-scale for magnification calibration. This micro-scale had been calibrated through the metrological atomic force microscope (AFM) of National Metrology Institute of Japan (NMIJ), which ensures traceability to the International System of Units (SI). The certified values, therefore, are traceable to the SI.

Expiration of Certification

This certificate is valid for one year from the date of shipment, provided that this CRM is stored in accordance with the instructions given in this certificate.

Description of the Material

This CRM is a thin plate with dimensions of 7 mm × 7 mm × 0.7 mm. A dot-array is on one side of a double-side-polished substrate. The dot array is placed in a plastic container in an upright position and individually packaged. The substrate contains the pattern shown in Fig. 1(a), and the dot-array with the certified dot pitch is located in region A at the upper left. The x and y directions are defined as indicated in the figure. A typical SEM image of the dot-array is shown in Fig. 1(b).

Sample

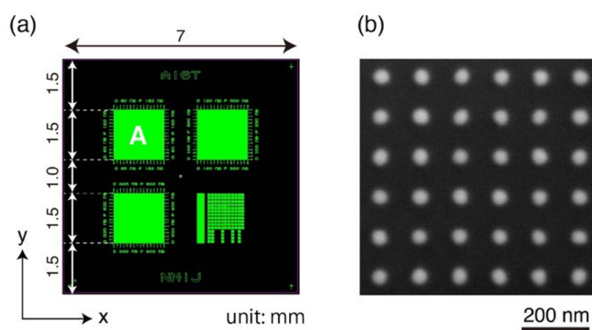


Figure 1 Chip pattern of the CRM (a). Typical SEM image of the dot-array (b). Accelerating voltage was 3 kV.

Instructions for Storage

This CRM should be stored in a desiccator under atmospheric conditions at temperatures between 5 °C to 35 °C and a volumetric absolute humidity of 5.8 g/m³ or less (equivalent to a relative humidity of 30% or less at 22 °C).

Instructions for Use

This CRM may have few dots with shape anomalies in the dot-array. These dots should be kept out of the field of view of a micrograph for the magnification calibration or image sharpness evaluation with this CRM. Clean area of the CRM should be chosen for SEM observations that shows no effect of carbon contamination caused by electron beam irradiation. Use this CRM under temperature conditions between 5 ºC and 35 ºC. In the magnification calibration of a scanning electron microscope with this CRM, it is recommended that the actual number of dot intervals to be measured should be about 10.

Precautions for Handling

In order to avoid surface contamination of the CRM, appropriate tools such as clean gloves and tweezers should be used in handling. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

TaN dot-array was fabricated on a 300-mm silicon wafer by semiconductor fabrication technologies in the super clean room facility in TIA central office, National Institute of Advanced Industrial Science and Technology, and then individually packed in NMIJ.

NMIJ Analysts

The technical manager for this CRM is MISUMI I., the production manager is KUMAGAI K., and the analyst is KUMAGAI K.

Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customers. Customer registration on the NMIJ Website (given below) will facilitate notification. Technical reports regarding this CRM can be obtained from the contact details given below.

Reproduction of Certificate

In reproducing this certificate, it should be clearly indicated that the document is a copy.

Sample

February 26, 2026

ISHIMURA Kazuhiko
President
National Institute of Advanced Industrial Science and Technology

If you have any questions about this CRM, please contact:
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National Metrology Institute of Japan,
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