Date of shipment: Xxxxxx 00, 2017 5204b00130327-170831

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 5204-b

No. +++

Ultrathin Silicon Dioxide Film

National Institute of Advanced Industrial Science and Technology AIST

This certified reference material (CRM) was produced in accordance with the NMIJ's management system and in compliance with ISO GUIDE 34:2009 and ISO/IEC 17025:2005. This CRM is intended for use in controlling the precision of analysis and validating analytical methods or instruments during depth profile analysis and thickness measurements.

Certified Value

The certified value, thickness of silicon dioxide, is given in the table below. The uncertainty of the certified value is the half-width of the expanded uncertainty interval calculated using a coverage factor (k) of 2, which gives a level of confidence of approximately 95 %.

	CAS Number	Certified Value Thickness (nm)	Expanded Uncertainty Thickness (nm)
Silicon dioxide	7631-86-9	3.26	0.42

Determination of Certified Values

The certified value of this CRM was determined by grazing incidence X-ray reflectometry (XRR).

Metrological Traceability

The certified value of this CRM was determined based on the recommended value of X-ray wavelength by CODATA and the calibrated angle. It is traceable to the International System of Units (SI).

Expiration of Certification

This certificate is valid for 6 months from the date of shipment, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM is in the form of a 15-mm square chip kept with ultra-pure water in a fluororesin container. The container is sealed in an aluminum-laminated plastic bag.

Homogeneity

Uniformity of the CRM was confirmed by XRR measurements for 7 specimens selected randomly from 47 samples cut from a single wafer. The variance between specimens is reflected to the uncertainty of the certified value.

Instructions for Storage

The CRM should be kept at clean and cold place (below 10 °C) and should not be frozen. Ultra-pure water in the container should be replaced once a month.

Instructions for Use

The certified values of this CRM represent the thickness of whole area of sample. Several points on the CRM should be measured and the mean value should be used in cases that the measurement area is much smaller than the size of the CRM.

Precautions for Handling

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

Preparation Method

The oxide film of the CRM was formed by highly-concentrated ozone-gas method on a Si(100) substrate (200 mm, 1 Ω cm, B-doped) and then the chips of the CRM were cut from the wafer.

NMIJ Analysts

The technical manager for the CRM is A. Kurokawa and the production manager and the analyst is Y. Azuma.

Technical Information

Customer registration on the NMIJ Website (given below) will facilitate notification of any revision of the information given above. 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.

April 1, 2015

Ryoji Chubachi
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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Phone: +81-29-861-4059; Fax: +81-29-861-4009, https://www.nmij.jp/english/service/C/

Revision history
April 1, 2015: "Metrology Management Center" was renamed to "Center for Quality Management of Metrology."