

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 5205-a
No. +++

Multiple BN Delta-Layer Film

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 controlling the precision of analysis, and adjusting the measurement conditions, during depth-profile analysis by Secondary Ion Mass Spectrometry (SIMS).

Certified Value

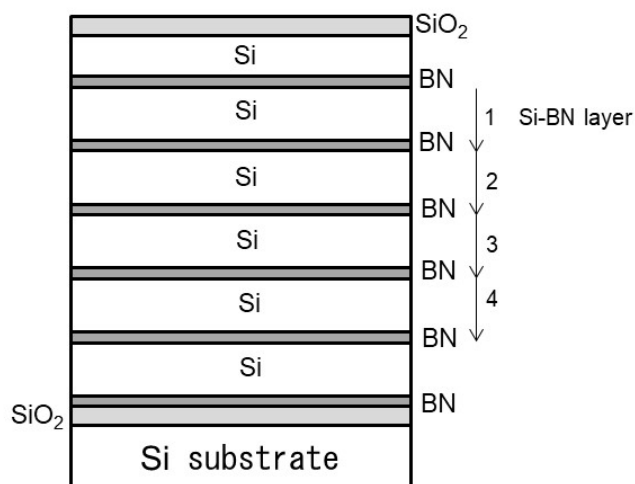
This CRM has multiple BN delta-layers within a Si film, and the certified value for the thicknesses of a pair of Si layers and the BN delta-layer is given in the table below. The uncertainty of the certified value is the expanded uncertainty obtained by multiplying the combined standard uncertainty by 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 %.

	CAS No.	Certified value, Total thickness of Si layer and BN delta- layer (nm)	Expanded uncertainty, Thickness (nm)
Si film with multiple BN delta-layers	Si:7440-21-3 BN:10043-11-5	8.24	0.17

The figure shows a schematic view of the CRM. The six Si film with inserted BN delta-layer (Si-BN layer) was deposited on the substrate. The thicknesses of one layer of the Si-BN layer shown as 1 to 4 in the figure were certified, except for the uppermost and lowermost structures on the sample.

Analysis

The certified value is determined by X-ray reflectometry. The thicknesses of each Si-BN layer shown as 1 to 4 in the figure were evaluated respectively. The average value of these thicknesses was employed as the thickness of one layer of the Si-BN layer.

**Metrological Traceability**

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

Expiration of Certification

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

Description of the Material

This CRM is in the form of a rectangle chip 7.5 mm in width and 15 mm in length, packaged in a plastic container. The multiple-delta layer structure was deposited on the polished surface (one side of the CRM), and this CRM is placed in a container with the side of sample surface facing down.

Instructions for Storage

This CRM should be stored in a dry and clean environment at a temperature between 5 °C and 35 °C.

Instructions for Use

The certified values of this CRM represent the thickness of the entire sample area. Several points on the CRM should therefore be measured, and the mean value used in case the measurement area is significantly smaller than the size of the CRM. The following international standards can be referred to for the calibration of depth-profile analysis results by SIMS and its related instrumentation.

ISO 20341:2003 Surface chemical analysis - Secondary-ion mass spectrometry - Method for estimating depth resolution parameters with multiple delta-layer reference materials

ISO 23812:2009 Surface chemical analysis - Secondary-ion mass spectrometry - Method for depth calibration for silicon using multiple delta-layer reference materials

Precautions for Handling

Clean gloves and tweezers should be used in handling to prevent contamination. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

The BN delta-layers and Si films of the CRM were formed by RF magnetron sputtering on a ϕ 100 mm Si substrate, and then the chips of the CRM were cut from the wafer.

NMIJ Analysts

The technical manager for the CRM is KUROKAWA A., and the production manager and analyst are AZUMA Y.

Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customer. 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.

April 1, 2020

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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Phone: +81-29-861-4059; Fax: +81-29-861-4009, <https://unit.aist.go.jp/nmij/english/refmate/>

Revision history

April 1, 2015: “Metrology Management Center” was renamed to “Center for Quality Management of Metrology.”

November 20, 2017: The description in “Expiration of Certification” was changed to “one year from the date of shipment.”

Sample