

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 5203-a

No. +++

GaAs/AIAs Super Lattice



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 condition during the depth-profile analysis by ion-sputtering with Auger electron spectroscopy, X-ray photoelectron spectroscopy and Secondary ion mass spectrometry and for use in controlling the precision of analysis and correcting the equipment during grazing incidence X-ray reflectivity analysis.

Certified Values

This CRM has a six-layer structure on a GaAs substrate and the certified values for the thickness from the second to sixth layer are given in the table below. The uncertainty of the certified values 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 %. The thicknesses of the surface oxide and the first GaAs layer are technical information because they are expected to change over time.

	CAS	Certified Value, Thickness (nm)	Expanded Uncertainty, Thickness (nm)
Surface oxide	—	—	—
First layer (GaAs)	1303-00-0	—	—
Second layer (AIAs)	22831-42-1	9.65	0.11
Third layer (GaAs)	1303-00-0	9.51	0.10
Fourth layer (AIAs)	22831-42-1	9.64	0.11
Fifth layer (GaAs)	1303-00-0	9.51	0.09
Sixth layer (AIAs)	22831-42-1	9.62	0.11

Analysis

Each certified value was determined by X-ray reflectometry.

Metrological Traceability

Each certified value was determined based on the calibrated X-ray wavelength from the CODATA-recommended values and the scanning angle of XRR experiments verified by the Japanese national angle standard. The certified values are 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 this CRM is stored in accordance with the instructions given in this certificate.

Description of the material

This CRM is in the form of a 15 mm square chip kept in a plastic container. The sample is placed upside down in the container.

Instructions for Storage

This CRM should be stored in a dry and clean environment at a temperature between 5 °C and 35 °C. The storage under the nitrogen flow is recommended.

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

Preparation

This CRM was deposited by molecular beam epitaxy. The deposition was carried out on 4-inch GaAs(100) wafers, then squares with one side of 15 mm were cleaved from the substrates.

Technical Information

The thicknesses of the surface oxide and the first GaAs layer at the time of the certification are given in the table below.

	CAS	Certified Value, Thickness (nm)	Expanded Uncertainty, Thickness (nm)	Technical information, Thickness (nm)
Surface oxide	—	—	—	1.32
First layer (GaAs)	1303-00-0	—	—	9.24
Second layer (AlAs) *	22831-42-1	9.65	0.11	—
Third layer (GaAs) *	1303-00-0	9.51	0.10	—
Fourth layer (AlAs) *	22831-42-1	9.64	0.11	—
Fifth layer (GaAs) *	1303-00-0	9.51	0.09	—
Sixth layer (AlAs) *	22831-42-1	9.62	0.11	—

* Certified value.

NMIJ Analysts

The technical manager for the CRM is FUJIMOTO T., the production manager is ZHANG L., and the analysts are AZUMA Y. and ZHANG L.

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.

April 1, 2020

ISHIMURA Kazuhiko
President

National Institute of Advanced Industrial Science and Technology

Date of Shipment: Xxxxx xx, 20xx

5203a00-070521-211125

If you have any questions about this CRM, please contact:
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Revision history

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

November 12, 2015: The description in “Expiration of Certification” was changed to “one year from the date of shipment.”

November 25, 2021: The thicknesses of the surface oxide and the first GaAs layer were added as the technical information.

Sample