National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 5808-a
No. +++

Molybdenum Film for Thermal Diffusivity Measurement (400 nm)

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 calibration and validation of instruments for thermal diffusivity measurements.

Certified Value

The certified value for thermal diffusivity in thickness direction of molybdenum film 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 %.

	Certified value, Thermal diffusivity (m^2/s)	Relative expanded uncertainty U (%)
Molybdenum film	3.28×10^{-5}	6.2

Analysis

The certified value of this CRM was determined from the thickness and the heat diffusion time in thickness direction of the molybdenum film. The film thickness was evaluated by the stylus instrument calibrated using the step height standard. The heat diffusion time was evaluated at 22.5 °C ± 0.5 °C by the pulsed light heating thermoreflectance method originally developed by NMIJ. The measurements were carried out at the center of the specimens within a radius of 5 mm.

Metrological Traceability

The certified value was determined based on the function generator and the step height standard as a primary method of measurement. The certified value, therefore, is traceable to the International System of Units (SI).

Expiration of Certification

This certificate is valid from the date of shipment to March 31, 2026, provided that the material remains unopened and is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM is in the form of a wafer with a diameter of 38.1 mm and a thickness of 0.525 mm. One wafer is kept in a polypropylene case, which is sealed in a plastic bag with a desiccant and an oxygen absorber.

Homogeneity

The homogeneity of this CRM was determined by analyzing 8 specimens randomly sampled from 50 wafers. The homogeneity of each specimen is reflected in the uncertainty of the certified value.

Instructions for Storage

This CRM should be stored in the sealed plastic bag at a temperature between 5 °C and 35 °C in clean environment.

Instructions for Use

Use the CRM surface within a radius of 10 mm from the center of the specimen, avoiding the line shape pattern with a width of 0.1 mm and a length of 3.0 mm. The molybdenum film must be damaged by water and oil. Wear gloves or use tweezers during handling to protect the CRM against contamination.

Precautions for Handling

The CRM is composed of molybdenum and quartz glass. Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

Molybdenum film was deposited on 50 pieces of synthesized quartz glass wafer by the dc magnetron sputtering. Deposited films were chemically etched using a lithography technique in order to remove the outer edge of the film and to make a line shape pattern at the center of the specimen.

Technical Information

Please note that the thermal diffusivity in-plane direction was not evaluated. There is a line shape pattern with a width of 0.1 mm and a length of 3.0 mm, at the center of the specimen, which is utilized for measuring thickness of the specimen in accordance with ISO5436-1:2000. The averaged thickness at the center of the sampled 8 specimens was 421.3 nm ± 0.5 nm. The standard deviation of the thickness at the center and outer edge was 2.4 nm.

NMIJ Analysts

For this CRM, the technical manager is YAMADA N., and the production manager and analyst are YAGI T.

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:
National Institute of Advanced Industrial Science and Technology,
National Metrology Institute of Japan,
Center for Quality Management of Metrology, Reference Materials Office,
1-1-1 Umezono, Tsukuba, Ibaraki 305-8563, Japan
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".
January 11, 2017: The limit of validity of the certificate was extended from "March 31, 2018" to "March 31, 2021".
October 17, 2019: The limit of validity of the certificate was extended from "March 31, 2021" to "March 31, 2026".