Date of Shipment: Xxxxx xx, 20xx 5810a00-210225-250314

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 5810-a

No. +++

Titanium Nitride Film for Thermal Diffusivity Measurement

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 based upon a pulsed light heating thermoreflectance method.

Certified Value

The certified value of this CRM is given in the table below. The uncertainty of the certified value is the relative expanded uncertainty obtained by multiplying the combined relative 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	Certified value Thermal diffusivity (m^2/s)	Relative expanded uncertainty U (%)
Titanium Nitride Film	3.43×10^{-6}	7.9

Analysis

The certified value of this CRM was determined from the thickness and the heat diffusion time in thickness direction of the titanium nitride film. The film thickness was evaluated by the stylus instrument calibrated using the step height standard. The heat diffusion time was evaluated by the pulsed light heating thermoreflectance method originally developed by NMIJ. Those measurements were carried out at the center of the specimens within a radius of 0.5 mm under the room temperature of 22.5 °C ± 0.5 °C. Note that the thermal diffusivity in-plane direction was not evaluated.

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 until 31 March 2029 from the date of shipment, provided that this CRM remains unopened and is stored in accordance with the instructions given in this certificate.

Description of the Material

This CRM is a reddish brown titanium nitride film formed on a quartz glass plate (10 mm × 10 mm × 0.525 mm). At the center of the film, an etched pattern with a width of 0.1 mm and a length of 1.0 mm was fabricated. The average film thickness determined from randomly-sampled 12 specimens was 543.8 nm, and its standard deviation was 3.4 nm. This CRM is packed in a polypropylene case, which is sealed in a plastic bag with a desiccant and a deoxidant.

Homogeneity

In the assessment of homogeneity of this CRM a significant inhomogeneity between specimens of about 1.7 % was observed. This uncertainty of homogeneity has been incorporated in the uncertainty of the certified value.

Instructions for Storage

This CRM should be stored at temperatures of 5 °C to 35 °C in clean environment.

Instructions for Use

Use the CRM avoiding the line shape pattern positioned at the center of the specimen. Wear gloves or use tweezers for handling the CRM against contamination.

Precautions for Handling

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

Preparation

Titanium nitride film was deposited on a quartz glass wafers by means of reactive dc magnetron sputtering method. Deposited films were cut into each specimen. The films were chemically etched using a lithography technique to remove outer edge of the film and a line shape pattern with a width of 0.1 mm and a length of 1.0 mm at the center of the specimen.

Technical Information

The line shape pattern with a width of 0.1 mm and a length of 1.0 mm at the center of the specimen can be utilized for measuring thickness of the specimen in accordance with ISO 5436-1:2000, Type A1.

NMIJ Analysts

The technical manager for this CRM is AKOSHIMA M., the production manager is YAGI T., and the analyst is YAGI T.

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.

February 25, 2021

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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