National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 3407-b01

Carbon Dioxide

This certified reference material (CRM) is high-purity carbon dioxide (CO_2). It is produced in accordance with the NMIJ's management system and in compliance with ISO 17034 and ISO/IEC 17025. This CRM is intended for use in the calibration of instruments for CO_2 determination.

Certified Value

The certified value of the purity (amount-of-substance fraction) of this CRM 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, Molar Fraction (mol/mol)	Expanded Uncertainty Molar Fraction (mol/mol)	Cylinder Number
Carbon Dioxide	124-38-9	0.9999935	0.0000062	3BIS-8782

Analysis

The concentration of each impurity was determined by the analytical methods listed below. The certified value was determined by the subtraction method, in which the impurities in this CRM were determined by the analytical methods listed below. The subtraction method was described in the ISO6142:2001"Gas analysis--Preparation of calibration gas mixtures--Gravimetric method".

Impurity	Analytical equipment
Nitrogen	Gas chromatograph with thermal conductivity detector
Oxygen	Gas chromatograph with thermal conductivity detector
Hydrogen	Gas chromatograph with thermal conductivity detector
Methane	Gas chromatograph with flame-ionization detector
Water	Capacitance-type hygrometer

Metrological Traceability

Analytical equipments used for the certification were calibrated using NMIJ's primary reference gases prepared by the gravimetric blending method. The capacitance type hygrometer was calibrated using reference dew point meter which was traceable to the primary standard at National Institute of Standard Technology (Gaithersburg, USA). Therefore, the certified value is traceable to the SI.

Mutual Recognition Arrangement under Metre Convention

The certified value of this CRM is recognized for international equivalence based on the Mutual Recognition Arrangement under the Metre Convention (CIPM MRA). The calibration measurement capability (capabilities) (CMC) of NMIJ related to this CRM is registered in the Key Comparison Database (KCDB) (see https://www.bipm.org/kcdb/) of the International Bureau of Weights and Measures (BIPM).

Expiration of Certification

This certificate is valid until 31 March 2023, from the date of shipment, provided that the material is handled and stored in accordance with the instructions given in this certificate.

Description of the material

This CRM is in the form of colorless and odorless gas supplied to users in a ten-liter manganese steel high-pressure gas cylinder with W22-14 threads right (male) outlet. The residual mass of the CRM in the cylinder is 4.5 kg or more at the time of the shipment. The residual mass is estimated from the following procedure; (1) Weigh the cylinder with the cylinder cap and the cap of outlet of valve taken off. (2) When the cylinder mass is a, the valve mass is b, and the mass of the cylinder body is c, the mass of the CRM in the cylinder equals $(a - (b + c))$. The mass of the cylinder body and the valve are marked on each surface.

Instructions for Storage

This CRM should be stored in compliance with regulations of high pressure gas and so on. A cylinder of this CRM should be stored away from direct sunlight and fire at a temperature of 40 °C or less in a well-ventilated place.

Instructions for Use

It is desirable that this CRM is used at room temperature from 20 °C to 26 °C. There is a possibility that the impurities in this liquefied gas CRM will increase or decrease with rapid temperature change. Pay attention to the stability of temperature of this cylinder. This CRM should be under the (estimated) residual mass of filled gas more than approximately 1 kg. It is recommended that a high-pressure regulator made of stainless steel and stainless steel tubes are used. Operation for purge should be repeated adequately, in order to prevent the contamination of the gas. Carbon dioxide in the cylinder must not be withdrawn in the liquid state. It must be withdrawn in the gaseous state. If carbon dioxide is withdrawn in the state of liquid, the certified value of carbon dioxide withdrawn from the cylinder and that of carbon dioxide left in the cylinder are not guaranteed.

Precautions for Handling

Refer to the safety data sheet (SDS) on this CRM before use.

Preparation

High-purity carbon dioxide gas was filled in a 10 liter manganese cylinder by SHOWA DENKO GAS PRODUCTS CO., LTD.

NMIJ Analysts

Technical manager for this CRM is SHIMOSAKA T. A responsibility for production is MATSUMOTO N. Analysts for production are MATSUMOTO N. and TAKADA K.

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,
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 21, 2021: The description in "Expiration of Certification" was changed to "31 March 2023".