

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan



Reference Material Certificate

NMIJ CRM 3407-a03

Carbon Dioxide



This certified reference material (CRM) is high-purity carbon dioxide (CO₂). It was produced in accordance with the NMIJ's management system, and in compliance with JIS Q 0034 (ISO GUIDE 34). This CRM is intended for use in the calibration of instruments for CO₂ 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 was determined using a coverage factor (k) of 2, corresponding to an estimated confidence interval of approximately 95 %.

	CAS No.	Certified value, Amount-of-substance fraction (mol/mol)	Expanded uncertainty, Amount-of-substance fraction (mol/mol)	Cylinder number
Carbon dioxide	124-38-9	0.9999951	0.0000036	3BIS-8786

Analysis

The certified value was determined using the analytical equipment listed below. The purity was determined by the subtraction method and complied with the requirements described in the ISO6142 (2nd edition), "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 equipment used for the certification was calibrated using the NMIJ's primary reference gases prepared by the gravimetric blending method. The capacitance-type hygrometer was calibrated using a reference dew-point meter that was traceable to the primary standard at the National Institute of Standard Technology (Gaithersburg, USA); moreover, the concentration of water in this CRM as measured by a hygrometer was much lower than that in other impurities. Therefore the certified values are traceable to the International System of Units (SI).

Expiration of Certification

This certificate is valid until March 31, 2015 from the date of shipment, provided that the material is handled and stored in accordance with the instructions given in this certificate.

Sample form

This CRM is in the form of colorless and odorless gas at room temperature and supplied to users in a ten-liter high-pressure manganese-steel cylinder with W22-14 right (male) outlet. At the time of supply, the in-cylinder remaining amount of the high-purity CO₂ gas is 4.5 kg or more. This in-cylinder remaining amount can be estimated using the following procedure: (1)

weigh the cylinder with the cap of the outlet valve and with the cylinder cap 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 gas in the cylinder equals $(a - (b + c))$. The mass of the cylinder body and the valve mass 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. The CRM should be fixed with chain to avoid overturning.

Instructions for Use

It is desirable that this CRM is used in the approximate temperature range from 18 °C to 31 °C, because the certified value is based on the analytical results obtained in this temperature range. There is a possibility that the impurities in this liquefied gas CRM will increase or decrease with a rapid change in temperature. Attention should be paid to the stability of the cylinder temperature. The (estimated) residual mass of the filled gas should be more than approximately 1 kg, because the amount of each impurity might depend on the residual mass. Use a pressure reducing valve and a pipe made of stainless steel etc., which are designed specifically for high-purity gases, when using this CRM, and purge the pipe thoroughly in order to prevent decline of the purity. 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.

Production Method

High-purity CO₂ gas was filled in a 10 L manganese-steel cylinder by Showa Tansan Co., Ltd.

NMIJ Analysts

For this CRM, the technical manager is K. Kato, the production manager is N. Matsumoto, and the analysts for production are N. Matsumoto, F. Noguchi, and Y. Sugai.

Technical Information

Customer registration on the NMIJ Website (given below) will facilitate notification of any revision of the information given above. 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, 2015

Ryoji Chubachi
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://www.nmij.jp/english/service/C/>

Revision history

April 1, 2010: The expiration date of this certificate was extended to March 31, 2015 from March 31, 2010 on the basis of the stability test results.

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

Sample