National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 3402-c01

Sulfur Dioxide

This certified reference material (CRM) was produced in accordance with the NMIJ's management system and in compliance with ISO GUIDE 34:2009 and ISO/IEC 17025:2005. This CRM is intended for use in the calibration of instruments for sulfur dioxide (SO_2) determination.

Certified Value

The certified value of this CRM 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 %.

	CAS No.	Certified value, Amount-of-substance fraction (μmol/mol)	Expanded uncertainty, Amount-of-substance fraction (μmol/mol)	Cylinder No.
Sulfur Dioxide	7446–09-5	0.99997	0.00010	3K-11238

Analysis

The certified value of this CRM is determined by the calculation method (the subtracting method) stipulated in ISO 6142 (2001), based on the concentration of impurities measured by the equipment shown in the table below:

Impurity	Equipment
Carbon dioxide	Gas chromatograph with thermal conductivity detector
Nitrogen	Gas chromatograph with thermal conductivity detector
Oxygen	Gas chromatograph with thermal conductivity detector
Argon	Gas chromatograph with thermal conductivity detector
Methane	Gas chromatograph with flame ionization detector
Propane	Gas chromatograph with flame ionization detector
Water	Fourier-transform infrared spectrometer

Metrological Traceability

The certified value of this CRM is obtained by quantifying impurities in the gas withdrawn from the container with the measurement equipment given above and applying the subtracting method. The gas chromatograph with thermal conductivity detector and the gas chromatograph with flame ionization detector are calibrated at NMIJ by using the calibration gases prepared by the gravimetric blending method (ISO 6142 (2001)). The Fourier-transform infrared spectrometer is calibrated by using the calibration gases whose values are assigned by the chilled mirror dew point meter traceable to the National Physical Laboratory (NPL). The certified value of this CRM, therefore, is traceable to the International System of Units (SI).

Mutual Recognition Arrangement under Meter Convention

This certificate is consistent with the calibration and measurement capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the

quantities, ranges and measurement uncertainties specified in Appendix C (as for Appendix C of MRA, see http://kcdb.bipm.org/AppendixC/default.asp).

Expiration of Certification

This certificate is valid from the date of shipment to March 31, 2021, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM is in the form of colorless gas at room temperature and supplied to users in a ten-liter high-pressure manganese-steel cylinder with W22-14-OR outlet. At the time of supply, the in-cylinder remaining amount is 1.7 kg or more. This in-cylinder remaining amount can be calculated by subtracting the mass stamped on a cylinder body and the mass engraved on a valve (outlet) from the weighed mass of the cylinder with its outlet cap taken off.

Instructions for Storage

This CRM, which is high-pressure gas, should be stored in accordance with the High Pressure Gas Safety Act. The cylinder of this CRM should be stored away from direct sunlight at a temperature of 40 ºC or less in a well-ventilated place. Appropriate precautions should be taken to prevent the cylinder from overturning, etc. Refer to the safety data sheet (SDS) on this CRM for storage.

Instructions for Use

This CRM should be left at rest for a sufficiently long time at room temperature before use. This CRM should be used only when the in-cylinder remaining amount is 1 kg or more because its purity may change as the in-cylinder remaining amount gets smaller. In the development of this CRM, it has been demonstrated that its purity remains unchanged when the in-cylinder remaining amount is between about 1.7 kg and about 6 kg. 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. Sulfur dioxide in the cylinder must not be withdrawn in the liquid state. It must be withdrawn in the gaseous state. If sulfur dioxide is withdrawn in the state of liquid, the certified value of sulfur dioxide withdrawn from the cylinder and that of sulfur dioxide left in the cylinder are not guaranteed.

Precautions for Handling

This CRM is high-pressure gas (liquefied and toxic gas), should be handled in accordance with the High Pressure Gas Safety Act. Sulfur dioxide is colorless toxic gas with unpleasant irritating odor and it causes irritation and corrosion in eyes, nose, throat, respiratory mucous membrane, and skin. Care must be taken, therefore, to avoid its leakage and inhalation. Refer to the SDS on this CRM before use.

Preparation

This CRM was packed into ten-liter high-pressure manganese-steel cylinders in Sumitomo Seika Chemicals Co., Ltd.

NMIJ Analysts

The technical manager for this CRM is T. Shimosaka; the production manager is N. Matsumoto, and the analyst is N. Matsumoto.

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.

November 12, 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/

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 3402-c02

Sulfur Dioxide

This certified reference material (CRM) was produced in accordance with the NMIJ's management system and in compliance with ISO GUIDE 34:2009 and ISO/IEC 17025:2005. This CRM is intended for use in the calibration of instruments for sulfur dioxide (SO_2) determination.

Certified Value

The certified value of this CRM 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 %.

	CAS No.	Certified value, Amount-of-substance fraction (μmol/mol)	Expanded uncertainty, Amount-of-substance fraction (μmol/mol)	Cylinder No.
Sulfur Dioxide	7466–09-5	0.99997	0.00010	5K-90716

Analysis

The certified value of this CRM is determined by the calculation method (the subtracting method) stipulated in ISO 6142 (2001), based on the concentration of impurities measured by the equipment shown in the table below:

Impurity	Equipment
Carbon dioxide	Gas chromatograph with thermal conductivity detector
Nitrogen	Gas chromatograph with thermal conductivity detector
Oxygen	Gas chromatograph with thermal conductivity detector
Argon	Gas chromatograph with thermal conductivity detector
Methane	Gas chromatograph with flame ionization detector
Propane	Gas chromatograph with flame ionization detector
Water	Fourier-transform infrared spectrometer

Metrological Traceability

The certified value of this CRM is obtained by quantifying impurities in the gas withdrawn from the container with the measurement equipment given above and applying the subtracting method. The gas chromatograph with thermal conductivity detector and the gas chromatograph with flame ionization detector are calibrated at NMIJ by using the calibration gases prepared by the gravimetric blending method (ISO 6142 (2001)). The Fourier-transform infrared spectrometer is calibrated by using the calibration gases whose value are assigned by the chilled mirror dew point meter traceable to the National Physical Laboratory (NPL). The certified value of this CRM, therefore, is traceable to the International System of Units (SI).

Mutual Recognition Arrangement under Meter Convention

This certificate is consistent with the calibration and measurement capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the

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Expiration of Certification

This certificate is valid from the date of shipment to March 31, 2021, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM is in the form of colorless gas at room temperature and supplied to users in a ten-liter high-pressure manganese-steel cylinder with W22-14-OR outlet. At the time of supply, the in-cylinder remaining amount is 5.5 kg or more. This in-cylinder remaining amount can be calculated by subtracting the mass stamped on a cylinder body and the mass engraved on a valve (outlet) from the weighed mass of the cylinder with its outlet cap taken off.

Instructions for Storage

This CRM, which is high-pressure gas, should be stored in accordance with the High Pressure Gas Safety Act. The cylinder of this CRM should be stored away from direct sunlight at a temperature of 40 ºC or less in a well-ventilated place. Appropriate precautions should be taken to prevent the cylinder from overturning, etc. Refer to the safety data sheet (SDS) on this CRM for storage.

Instructions for Use

This CRM should be left at rest for a sufficiently long time at room temperature before use. This CRM should be used only when the in-cylinder remaining amount is 1 kg or more because its purity may change as the in-cylinder remaining amount gets smaller. In the development of this CRM, it has been demonstrated that its purity remains unchanged when the in-cylinder remaining amount is between about 6 kg and about 1.7 kg. 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. Sulfur dioxide in the cylinder must not be withdrawn in the liquid state. It must be withdrawn in the gaseous state. If sulfur dioxide is withdrawn in the state of liquid, the certified value of sulfur dioxide withdrawn from the cylinder and that of sulfur dioxide left in the cylinder are not guaranteed.

Precautions for Handling

This CRM is high-pressure gas (liquefied and toxic gas), should be handled in accordance with the High Pressure Gas Safety Act. Sulfur dioxide is colorless toxic gas with unpleasant irritating odor and it causes irritation and corrosion in eyes, nose, throat, respiratory mucous membrane, and skin. Care must be taken, therefore, to avoid its leakage and inhalation. Refer to the SDS on this CRM before use.

Preparation

This CRM was packed into ten-liter high-pressure manganese-steel cylinders in Sumitomo Seika Chemicals Co., Ltd.

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