

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4403-a01



## Sulfur Hexafluoride and Tetrafluoromethane in Nitrogen (Emission Level)

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 primarily intended for use in calibrating the analytical instruments.

**Certified Value**

The certified values of this CRM are 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 ( $\mu\text{mol/mol}$ )	Expanded uncertainty, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Cylinder No.
Sulfur Hexafluoride	2551-62-4	111.84	0.37	CPB16390
Tetrafluoromethane	75-73-0	107.11	0.44	

**Analysis**

The certified values of this CRM are the synthesis concentration determined by the gravimetric blending method which is traceable to the International System of Units (SI). The uncertainty of the certified value was estimated by combining the uncertainty of the gravimetric blending method, the uncertainty of synthesis evaluated by the gas chromatograph with thermal conductivity detector, and the uncertainty derived from the long-term stability.

**Metrological Traceability**

This CRM is the primary standard gas prepared at NMIJ by using the precision electronic balance and source gases, both of which are traceable to the SI. This CRM, therefore, is traceable to the SI.

**Expiration of Certification**

This certificate is valid until March 31, 2020, provided that the material is stored in accordance with the instructions given in this certificate.

**Sample Form**

This CRM is high-pressure gas and supplied in a ten-liter high-pressure aluminum-alloy cylinder with W22-14-OR outlet. At the time of shipment, the internal pressure is about 6 MPa or more in gauge pressure.

**Instructions for Storage**

This CRM, which is high-pressure gas, should be stored in accordance with the High Pressure Gas Safety Act. A cylinder of this CRM should be stored away from direct sunlight at a temperature of 40 °C 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**

Piping and pressure-reducing valves made of stainless steel should be used in order to prevent penetration of air components from air and penetration of impurities from the piping system, etc. Thorough gas purge should be performed before use in order to displace residual gases and adsorbed substances in the piping system. Care must be taken against ventilation, etc. since nitrogen gas used as dilution gas poses a suffocation hazard. The minimum operating pressure is 2 MPa.

**Precautions for Handling**

Care must be taken against fire and ventilation. This CRM should be handled, stored and returned in accordance with the High Pressure Gas Safety Act. The minimum operating pressure is 2 MPa. Refer to the SDS on this CRM before use.

**Preparation**

NMIJ performed the purity analysis for high-purity sulfur hexafluoride gas, high-purity methane tetrafluoride gas, and high-purity nitrogen gas sourced from commercial companies on October 30 and 31, 2004. These high-purity gases were filled into high-pressure aluminum-alloy cylinders at the NMIJ high-pressure gas production facility on November 12, 2004 to December 1, 2004.

**NMIJ Analysts**

The technical manager for this CRM is KATO K, the production manager is MATSUMOTO N., and the analysts are MATSUMOTO N. and NOGUCHI F.

**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**

December 8, 2009: The limit of validity of the report was extended from "October 31, 2009" to "March 31, 2020."

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

National Institute of Advanced Industrial Science and Technology

## National Metrology Institute of Japan



## Reference Material Certificate

NMIJ CRM 4403-a02



## Sulfur Hexafluoride and Tetrafluoromethane in Nitrogen (Emission Level)

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 primarily intended for use in calibrating the analytical instruments.

**Certified Value**

The certified values of this CRM are 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 ( $\mu\text{mol/mol}$ )	Expanded uncertainty, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Cylinder No.
Sulfur Hexafluoride	2551-62-4	91.20	0.35	CPB16383
Tetrafluoromethane	75-73-0	82.96	0.50	

**Analysis**

The certified value of this CRM is the synthesis concentration determined by the gravimetric blending method which is traceable to the International System of Units (SI). The uncertainty of the certified value was estimated by combining the uncertainty of the gravimetric blending method, the uncertainty of synthesis evaluated by the gas chromatograph with thermal conductivity detector, and the uncertainty derived from the long-term stability.

**Metrological Traceability**

This CRM is the primary standard gas prepared at NMIJ by using the precision electronic balance and source gases, both of which are traceable to the SI. This CRM, therefore, is traceable to the SI.

**Expiration of Certification**

This certificate is valid until March 31, 2020, provided that the material is stored in accordance with the instructions given in this certificate.

**Sample Form**

This CRM is high-pressure gas and supplied in a ten-liter high-pressure aluminum-alloy cylinder with W22-14-OR outlet. At the time of shipment, the internal pressure is about 6 MPa or more in gauge pressure.

**Instructions for Storage**

This CRM, which is high-pressure gas, should be stored in accordance with the High Pressure Gas Safety Act. A cylinder of this CRM should be stored away from direct sunlight at a temperature of 40 °C 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**

Piping and pressure-reducing valves made of stainless steel should be used in order to prevent penetration of air components from air and penetration of impurities from the piping system, etc. Thorough gas purge should be performed before use in order to displace residual gases and adsorbed substances in the piping system. Care must be taken against ventilation, etc. since nitrogen gas used as dilution gas poses a suffocation hazard. The minimum operating pressure is 2 MPa.

**Precautions for Handling**

Care must be taken against fire and ventilation. This CRM should be handled, stored and returned in accordance with the High Pressure Gas Safety Act. The minimum operating pressure is 2 MPa. Refer to the SDS on this CRM before use.

**Preparation**

NMIJ performed the purity analysis for high-purity sulfur hexafluoride gas, high-purity methane tetrafluoride gas, and high-purity nitrogen gas sourced from commercial companies on October 30 and 31, 2004. These high-purity gases were packed into high-pressure aluminum-alloy cylinders at the NMIJ high-pressure gas production facility on November 12, 2004 to December 1, 2004.

**NMIJ Analysts**

The technical manager for this CRM is KATO K.; the production manager is MATSUMOTO N., and the analysts are MATSUMOTO N. and NOGUCHI F.

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## Reference Material Certificate

NMIJ CRM 4403-a03



## Sulfur Hexafluoride and Tetrafluoromethane in Nitrogen (Emission Level)

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 primarily intended for use in calibrating the analytical instruments.

**Certified Value**

The certified values of this CRM are 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 ( $\mu\text{mol/mol}$ )	Expanded uncertainty, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Cylinder No.
Sulfur Hexafluoride	2551-62-4	85.34	0.33	CPB16455
Tetrafluoromethane	75-73-0	86.84	0.41	

**Analysis**

The certified value of this CRM is the synthesis concentration determined by the gravimetric blending method which is traceable to the International System of Units (SI). The uncertainty of the certified value was estimated by combining the uncertainty of the gravimetric blending method, the uncertainty of synthesis evaluated by the gas chromatograph with thermal conductivity detector, and the uncertainty derived from the long-term stability.

**Metrological Traceability**

This CRM is the primary standard gas prepared at NMIJ by using the precision electronic balance and source gases, both of which are traceable to the SI. This CRM, therefore, is traceable to the SI.

**Expiration of Certification**

This certificate is valid until March 31, 2020, provided that the material is stored in accordance with the instructions given in this certificate.

**Sample Form**

This CRM is high-pressure gas and supplied in a ten-liter high-pressure aluminum-alloy cylinder with W22-14-OR outlet. At the time of shipment, the internal pressure is about 6 MPa or more in gauge pressure.

**Instructions for Storage**

This CRM, which is high-pressure gas, should be stored in accordance with the High Pressure Gas Safety Act. A cylinder of this CRM should be stored away from direct sunlight at a temperature of 40 °C 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**

Piping and pressure-reducing valves made of stainless steel should be used in order to prevent penetration of air components from air and penetration of impurities from the piping system, etc. Thorough gas purge should be performed before use in order to displace residual gases and adsorbed substances in the piping system. Care must be taken against ventilation, etc. since nitrogen gas used as dilution gas poses a suffocation hazard. The minimum operating pressure is 2 MPa.

**Precautions for Handling**

Care must be taken against fire and ventilation. This CRM should be handled, stored and returned in accordance with the High Pressure Gas Safety Act. The minimum operating pressure is 2 MPa. Refer to the SDS on this CRM before use.

**Preparation**

NMIJ performed the purity analysis for high-purity sulfur hexafluoride gas, high-purity methane tetrafluoride gas, and high-purity nitrogen gas sourced from commercial companies on October 30 and 31, 2004. These high-purity gases were packed into high-pressure aluminum-alloy cylinders at the NMIJ high-pressure gas production facility on November 12, 2004 to December 1, 2004.

**NMIJ Analysts**

The technical manager for this CRM is KATO K.; the production manager is MATSUMOTO N., and the analysts are MATSUMOTO N. and NOGUCHI F.

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## Reference Material Certificate

NMIJ CRM 4403-a04



## Sulfur Hexafluoride and Tetrafluoromethane in Nitrogen (Emission Level)

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 primarily intended for use in calibrating the analytical instruments.

**Certified Value**

The certified values of this CRM are 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 ( $\mu\text{mol/mol}$ )	Expanded uncertainty, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Cylinder No.
Sulfur Hexafluoride	2551-62-4	107.06	0.36	CPB16389
Tetrafluoromethane	75-73-0	107.35	0.44	

**Analysis**

The certified value of this CRM is the synthesis concentration determined by the gravimetric blending method which is traceable to the International System of Units (SI). The uncertainty of the certified value was estimated by combining the uncertainty of the gravimetric blending method, the uncertainty of synthesis evaluated by the gas chromatograph with thermal conductivity detector, and the uncertainty derived from the long-term stability.

**Metrological Traceability**

This CRM is the primary standard gas prepared at NMIJ by using the precision electronic balance and source gases, both of which are traceable to the SI. This CRM, therefore, is traceable to the SI.

**Expiration of Certification**

This certificate is valid until March 31, 2020, provided that the material is stored in accordance with the instructions given in this certificate.

**Sample Form**

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**Instructions for Storage**

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**Instructions for Use**

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**Precautions for Handling**

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**Preparation**

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## Reference Material Certificate

NMIJ CRM 4403-a05



## Sulfur Hexafluoride and Tetrafluoromethane in Nitrogen (Emission Level)

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	CAS No.	Certified value, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Expanded uncertainty, Amount-of-substance fraction ( $\mu\text{mol/mol}$ )	Cylinder No.
Sulfur Hexafluoride	2551-62-4	97.76	0.32	CPB16243
Tetrafluoromethane	75-73-0	97.24	0.40	

**Analysis**

The certified value of this CRM is the synthesis concentration determined by the gravimetric blending method which is traceable to the International System of Units (SI). The uncertainty of the certified value was estimated by combining the uncertainty of the gravimetric blending method, the uncertainty of synthesis evaluated by the gas chromatograph with thermal conductivity detector, and the uncertainty derived from the long-term stability.

**Metrological Traceability**

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