National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 3410-a01

Nitrogen for LNG analysis

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 and source material of nitrogen reference gas mixtures for liquefied natural gas (LNG) analysis.

Certified Value
The certified value for nitrogen in 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%.

<table>
<thead>
<tr>
<th>Impurities</th>
<th>Analytical Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen, Argon</td>
<td>Gas chromatograph with thermal-conductivity detector</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Gas chromatograph with flame-ionization detector and methanizer</td>
</tr>
<tr>
<td>Total hydrocarbons</td>
<td>Total hydrocarbon analyzer</td>
</tr>
<tr>
<td>Water</td>
<td>Chilled mirror hygrometer</td>
</tr>
</tbody>
</table>

Analysis
The amount-of-substance fraction of each impurity was determined using the analytical instruments listed below. The certified value was determined by the subtraction method (ISO 6142-1:2015).

<table>
<thead>
<tr>
<th>Impurities</th>
<th>Analytical Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen, Argon</td>
<td>Gas chromatograph with thermal-conductivity detector</td>
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</tr>
<tr>
<td>Water</td>
<td>Chilled mirror hygrometer</td>
</tr>
</tbody>
</table>

Metrological Traceability
The gas chromatographs and the total hydrocarbon analyzer used for certification were calibrated using NMIJ’s primary reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The chilled mirror hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

Expiration of Certification
This certificate is valid for one year from the date of shipment, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form
This CRM, which is colorless and odorless gas, is supplied in a manganese steel high-pressure gas cylinder with an inner volume of 10 L. The specification of the cylinder outlet is W22-14 threads right (male). The residual pressure of this CRM in the cylinder is more than 10 MPa.
Instructions for Storage
This CRM should be stored in compliance with local high pressure gases regulations. This CRM should be stored at a temperature below 40 °C in a well-ventilated area. Refer to the safety data sheet (SDS) on this CRM for storage.

Instructions for Use
This CRM should be used at around room temperature. This certificate is valid when the residual pressure of this CRM is 1.5 MPa or more gauge pressure. Use of a high-pressure regulator made of stainless steel and stainless-steel tubes is recommended. It is recommended that sufficient substitution of residual gas in a regulator, valves, piping, measuring instruments, and so on with this CRM before use. To avoid contamination, we recommend checking leakage from the joints of piping.

Precautions for Handling
Refer to the SDS on this CRM before use. This CRM should be returned to the Center for Quality Management of Metrology of AIST after use or after the expiry date.

Preparation
The 10-L manganese steel cylinder was filled with high purity nitrogen by JAPAN FINE PRODUCTS CO., LTD.

NMIJ Analysts
The technical manager for this CRM is T. Shimosaka. The production manager is N. Matsumoto. The analysts are N. Matsumoto and K. Takada.

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.

March 14, 2018
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/
Date of Shipment: ***** xx, 20XX

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate
NMIJ CRM 3410-a02

Nitrogen for LNG analysis

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 and source material of nitrogen reference gas mixtures for liquefied natural gas (LNG) analysis.

Certified Value

The certified value for nitrogen in 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%.

<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS No.</th>
<th>Certified value, Amount-of-substance fraction (mol/mol)</th>
<th>Expanded uncertainty Amount-of-substance fraction (mol/mol)</th>
<th>Cylinder Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>0.999996</td>
<td>0.000004</td>
<td>4MK-20834</td>
</tr>
</tbody>
</table>

Analysis

The amount-of-substance fraction of each impurity was determined using the analytical instruments listed below. The certified value was determined by the subtraction method (ISO 6142-1:2015).

<table>
<thead>
<tr>
<th>Impurities</th>
<th>Analytical Instruments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen, Argon</td>
<td>Gas chromatograph with thermal-conductivity detector</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Gas chromatograph with flame-ionization detector and nickel as catalyst</td>
</tr>
<tr>
<td>Total hydrocarbons</td>
<td>Total hydrocarbon analyzer</td>
</tr>
<tr>
<td>Water</td>
<td>Chilled mirror hygrometer</td>
</tr>
</tbody>
</table>

Metrological Traceability

The gas chromatographs and the total hydrocarbon analyzer used for certification were calibrated using NMIJ’s primary reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The chilled mirror hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

Expiration of Certification

This certificate is valid for one year from the date of shipment, provided that the material is stored in accordance with the instructions given in this certificate.

Sample Form

This CRM, which is colorless and odorless gas, is supplied in a manganese steel high-pressure gas cylinder with an inner volume of 10 L. The specification of the cylinder outlet is W22-14 threads right (male). The residual pressure of this CRM in the cylinder is more than 10 MPa.
Instructions for Storage
This CRM should be stored in compliance with local high pressure gases regulations. This CRM should be stored at a temperature below 40 °C in a well-ventilated area. Refer to the safety data sheet (SDS) on this CRM for storage.

Instructions for Use
This CRM should be used at around room temperature. This certificate is valid when the residual pressure of this CRM is 1.5 MPa or more gauge pressure. Use of a high-pressure regulator made of stainless steel and stainless-steel tubes is recommended. It is recommended that sufficient substitution of residual gas in a regulator, valves, piping, measuring instruments, and so on with this CRM before use. To avoid contamination, we recommend checking leakage from the joints of piping.

Precautions for Handling
Refer to the SDS on this CRM before use. This CRM should be returned to the Center for Quality Management of Metrology of AIST after use or after the expiry date.

Preparation
The 10-L manganese steel cylinder was filled with high purity nitrogen by JAPAN FINE PRODUCTS CO., LTD.

NMIJ Analysts
The technical manager for this CRM is T. Shimosaka. The production manager is N. Matsumoto. The analysts are N. Matsumoto and K. Takada.

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Phone: +81-29-861-4059; Fax: +81-29-861-4009, https://www.nmij.jp/english/service/C/
Date of Shipment: ***** xx, 20XX

National Institute of Advanced Industrial Science and Technology
National Metrology Institute of Japan

Reference Material Certificate
NMIJ CRM 3410-a03

Nitrogen for LNG analysis

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 and source material of nitrogen reference gas mixtures for liquefied natural gas (LNG) analysis.

Certified Value
The certified value for nitrogen in 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%.

<table>
<thead>
<tr>
<th>Impurities</th>
<th>Certified value, Amount-of-substance fraction (mol/mol)</th>
<th>Expanded uncertainty Amount-of-substance fraction (mol/mol)</th>
<th>Cylinder Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>0.000004</td>
<td>4MK-20835</td>
</tr>
<tr>
<td>Oxygen, Argon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hydrocarbons</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
<td></td>
</tr>
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Analysis
The amount-of-substance fraction of each impurity was determined using the analytical instruments listed below. The certified value was determined by the subtraction method (ISO 6142-1:2015).

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<thead>
<tr>
<th>Impurities</th>
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Metrological Traceability
The gas chromatographs and the total hydrocarbon analyzer used for certification were calibrated using NMIJ’s primary reference gases prepared by the gravimetric method in accordance with ISO 6142-1:2015. The chilled mirror hygrometer was calibrated using a reference dew point meter traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

Expiration of Certification
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Precautions for Handling
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Preparation
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NMIJ Analysts
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Date of Shipment: ***** xx, 20XX

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Reference Material Certificate
NMIJ CRM 3410-a04

Nitrogen for LNG analysis

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