Date of Shipment: Xxxxx xx, 20xx

4067a01-190220-210121

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 4067-a01

Isopentane

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 intended for use in the calibration of instruments and for use as a source material of isopentane reference gas mixtures for natural gas analysis.

Certified Value

The certified value 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 %.

Substance	CAS No.	Certified value Amount-of-substance fraction (mol/mol)	Expanded uncertainty Amount-of-substance fraction (mol/mol)	Cylinder number
Isopentane (2-Methylbutane)	78-78-4	0.995	0.006	Y-A41573

Analysis

A gas mixture was prepared by diluting this CRM with pure nitrogen, using a gravimetric method in accordance with ISO 6142-1:2015. A gas chromatograph with flame ionization detector equipped with two reaction parts between a column and the detector (post-column reaction GC-FID system) was used to determine amount-of-substance fraction of isopentane in the gas mixture. The certified value was determined from the dilution ratio of the gravimetric method and the amount-of-substance fraction determined by the post-column reaction GC-FID system.

Metrological Traceability

Mass pieces and an electronic balance used in the gravimetric method are traceable to the International System of Units (SI). The post-column reaction GC-FID system was calibrated by using standard gas mixtures which were prepared from NMIJ CRM 4052-b propane, NMIJ CRM 4064-a ethane, and NMIJ CRM 4066-a butane by means of the gravimetric method. The certified value, therefore, is traceable to the SI.

Expiration of Certification

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

Description of the material

This CRM is delivered in a manganese steel cylinder with an inner volume of approximately 1.0 L. The specification of the cylinder outlet is W22.5-14 threads left female.

Instructions for Storage

This CRM should not be exposed to sunlight. This CRM should be stored at temperatures of 0 °C to 40 °C in a well-ventilated

area. The cylinder containing this CRM should be secured with a chain to prevent it from falling. As isopentane is flammable, this CRM should be kept away from open flames and ignition sources. Care should be taken to ensure that there are no leaks. Refer to the safety data sheet (SDS) on this CRM for details.

Instructions for Use

Since the pressure in the cylinder is lower than the atmospheric pressure, care should be taken not to introduce atmospheric air into the cylinder. It is recommended to sufficiently displace residual gas in valves, piping systems, measuring instruments and other relevant apparatus of this CRM before use. To avoid contamination of the environment, it is recommended to check pipe joints for leaks. This CRM in liquid phase must not be eluted. The certification becomes invalid if this CRM in liquid phase is eluted or if the accumulated use of this CRM exceeds 100 g. It is necessary to record the weight of the cylinder at the time of delivery and the cumulative use of this CRM.

Precautions for Handling

This CRM should be handled at temperatures of 0 °C to 40 °C in a well-ventilated area. Personal protective equipment should be used to handle this CRM. This CRM should be kept away from open flames. This CRM should be returned to Center for Quality Management of Metrology of AIST after use or after the expiry date. This CRM should be used in a well-ventilated area. Refer to the SDS on this CRM before use.

Preparation

Isopentane was purified and packed in the cylinder by Takachiho Chemical Industrial Co., Ltd.

NMIJ Analysts

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T. and TAKADA K.

Information

If substantive technical changes occur that affect the certification before the expiration of this certificate, NMIJ will notify the registered customers. 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/

Date of Shipment: Xxxxx xx, 20xx

4067a02-190220-210121

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 4067-a02

Isopentane

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 intended for use in the calibration of instruments and for use as a source material of isopentane reference gas mixtures for natural gas analysis.

Certified Value

The certified value 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 %.

Substance	CAS No.	Certified value Amount-of-substance fraction (mol/mol)	Expanded uncertainty Amount-of-substance fraction (mol/mol)	Cylinder number
Isopentane (2-Methylbutane)	78-78-4	0.995	0.005	Y-A60525

Analysis

A gas mixture was prepared by diluting this CRM with pure nitrogen, using a gravimetric method in accordance with ISO 6142-1:2015. A gas chromatograph with flame ionization detector equipped with two reaction parts between a column and the detector (post-column reaction GC-FID system) was used to determine amount-of-substance fraction of isopentane in the gas mixture. The certified value was determined from the dilution ratio of the gravimetric method and the amount-of-substance fraction determined by the post-column reaction GC-FID system.

Metrological Traceability

Mass pieces and an electronic balance used in the gravimetric method are traceable to the International System of Units (SI). The post-column reaction GC-FID system was calibrated by using standard gas mixtures which were prepared from NMIJ CRM 4052-b propane, NMIJ CRM 4064-a ethane, and NMIJ CRM 4066-a butane by means of the gravimetric method. The certified value, therefore, is traceable to the SI.

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This CRM is delivered in a manganese steel cylinder with an inner volume of approximately 1.0 L. The specification of the cylinder outlet is W22.5-14 threads left female.

Instructions for Storage

This CRM should not be exposed to sunlight. This CRM should be stored at temperatures of 0 °C to 40 °C in a well-ventilated

area. The cylinder containing this CRM should be secured with a chain to prevent it from falling. As isopentane is flammable, this CRM should be kept away from open flames and ignition sources. Care should be taken to ensure that there are no leaks. Refer to the safety data sheet (SDS) on this CRM for details.

Instructions for Use

Since the pressure in the cylinder is lower than the atmospheric pressure, care should be taken not to introduce atmospheric air into the cylinder. It is recommended to sufficiently displace residual gas in valves, piping systems, measuring instruments and other relevant apparatus of this CRM before use. To avoid contamination of the environment, it is recommended to check pipe joints for leaks. This CRM in liquid phase must not be eluted. The certification becomes invalid if this CRM in liquid phase is eluted or if the accumulated use of this CRM exceeds 100 g. It is necessary to record the weight of the cylinder at the time of delivery and the cumulative use of this CRM.

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Preparation

Isopentane was purified and packed in the cylinder by Takachiho Chemical Industrial Co., Ltd.

NMIJ Analysts

The technical manager for this CRM is SHIMOSAKA T., the production manager is WATANABE T., and the analysts are WATANABE T. and TAKADA K.

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Phone: +81-29-861-4059; Fax: +81-29-861-4009, https://unit.aist.go.jp/nmij/english/refmate/

Date of Shipment: Xxxxx xx, 20xx

4067a03-190220-210121

National Institute of Advanced Industrial Science and Technology

National Metrology Institute of Japan

Reference Material Certificate

NMIJ CRM 4067-a03

Isopentane

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 intended for use in the calibration of instruments and for use as a source material of isopentane reference gas mixtures for natural gas analysis.

Certified Value

The certified value 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 %.

Substance	CAS No.	Certified value Amount-of-substance fraction (mol/mol)	Expanded uncertainty Amount-of-substance fraction (mol/mol)	Cylinder number
Isopentane (2-Methylbutane)	78-78-4	0.996	0.006	Y-A79785

Analysis

A gas mixture was prepared by diluting this CRM with pure nitrogen, using a gravimetric method in accordance with ISO 6142-1:2015. A gas chromatograph with flame ionization detector equipped with two reaction parts between a column and the detector (post-column reaction GC-FID system) was used to determine amount-of-substance fraction of isopentane in the gas mixture. The certified value was determined from the dilution ratio of the gravimetric method and the amount-of-substance fraction determined by the post-column reaction GC-FID system.

Metrological Traceability

Mass pieces and an electronic balance used in the gravimetric method are traceable to the International System of Units (SI). The post-column reaction GC-FID system was calibrated by using standard gas mixtures which were prepared from NMIJ CRM 4052-b propane, NMIJ CRM 4064-a ethane, and NMIJ CRM 4066-a butane by means of the gravimetric method. The certified value, therefore, is traceable to the SI.

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