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

Reference Material Certificate

NMIJ CRM 4036-a
No. +++
Dibromochloromethane

This certified reference material (CRM) was produced in accordance with the NMIJ’s management system, and in compliance with ISO Guide 34:2000 and ISO/IEC 17025:2005. It is primarily intended for use in calibrating analytical instruments. It is also intended for quality control of analytical instruments, and validation of analytical techniques and instruments.

Certified Value
The certified value is purity (amount of substance fraction), 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 (κ) 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>
</tr>
</thead>
<tbody>
<tr>
<td>Dibromochloromethane</td>
<td>124-48-1</td>
<td>0.9997</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

Analysis
The certified value of this CRM was determined by the freezing point depression method with a differential scanning calorimeter (DSC) by using stepwise scan method. Combined standard uncertainty of the certified value was estimated by the combination of standard uncertainties due to purity determination, homogeneity test and stability test.

Metrological Traceability
The certified value of this CRM was determined by a primary method of measurement, the freezing point depression method with a DSC. Scales of temperature and enthalpy of the DSC were calibrated with NIST SRM 2225 (mercury) and NIST SRM 2232 (indium) and they were traceable to the International System of Units (SI). Therefore, the certified value is traceable to the SI.

Indicative Value
Purity (mass fraction) is (0.9998±0.0003) kg/kg, where the number following the symbol ± is the half width of the expanded uncertainty interval calculated using coverage factor (κ) of 2, which gives a level of confidence of approximately 95%. The purity (mass fraction) was converted from the purity (amount of substance fraction) using the estimated average molecular weight of impurities.

Mutual Recognition Arrangement under Metre 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 for one year after the date of shipment, provided that the CRM remains unopened and stored in accordance with the instructions given in this certificate.

Sample Form
This CRM is in the form of a colorless and clear liquid at room temperature. This CRM is sealed in an amber glass ampoule with argon gas. The net amount is 5 mL for each ampoule.

Homogeneity
Ten ampoules were sampled from 200 subdivided ampoules with almost same intervals in order of subdivision for homogeneity tests by gas chromatography and Karl-Fischer titrimetry. Area percentages of dibromochloromethane by gas chromatography and water content by Karl-Fischer titrimetry were measured and evaluated as homogeneity tests. The evaluated variation of purity (amount of substance fraction) between the ampoules due to inhomogeneity was taken into account for the uncertainty of the certified value. Thus, this CRM is homogeneous within the range of the uncertainty of the certified value.

Instructions for Storage
This CRM should be stored in a cold (around –20 °C) and shielded from lights.

Instructions for Use
This CRM is for laboratory use only. The ampoule of this CRM should be allowed to warm to room temperature before use, and then shaken well. This CRM should be used promptly once an ampoule is opened.

Precautions for Handling
Keep away from heat and ignition sources. Avoid breathing vapor. The CRM should be used in a well-ventilated place. Wear protective equipment such as safety glasses, safety mask and safety gloves in handling. Refer to the safety data sheet (SDS) on this material before use.

Preparation Method
This CRM was purified and subdivided by KANTO CHEMICAL CO., INC. This CRM was purified by distillation and drying. 2-methyl-2-butene was put into the distillate as a stabilizer. Five milliliters each of dibromochloromethane was filled into amber glass ampoule in argon atmosphere.

NMIJ Analysts
Technical manager for this CRM is M. Numata. The person responsible for production is Y. Shimizu. Production analysts are Y. Shimizu, K. Ishikawa, Y. Kitamaki, Y. Ohte, X. Bao, E. Yoshimura and U. Horiuchi.

Collaborator
Stability tests until 2005 were performed by National Institute of Technology and Evaluation.

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
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Revision history
March 16, 2011: The certified value was reassigned based on the reassessments of homogeneity and stability.
March 27, 2015: The description in “Expiration of Certification” was changed to “one year after the date of shipment.”
April 1, 2015: “Metrology Management Center” was renamed to “Center for Quality Management of Metrology.”