National Institute of Standards and Technology
U.S. Department of Commerce

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Standard Reference Material® 2637a
Carbon Monoxide in Nitrogen
(Nominal Amount-of-Substance Fraction 2500 µmol/mol)
Lot 56-F-XX

CERTIFICATE OF ANALYSIS

Purpose: The certified value delivered by this Standard Reference Material (SRM) is intended for the calibration of instruments used for carbon monoxide determinations and for other applications.

Description: This SRM is a primary gas mixture supplied in a DOT 3AL-specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psig), which provides the user with 0.70 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-350 brass valve, which is the recommended outlet for this carbon monoxide mixture.

Certified Values: A NIST certified value is a value for which NIST has the highest confidence in that all known or suspected sources of bias and imprecision have been taken into account [1]. This SRM mixture has been certified for carbon monoxide amount-of-substance fraction (mole fraction, sometimes termed "molar concentration"). This certified value is traceable to the International System of Units (SI) through the gravimetric primary standards and procedures used in the preparation of this mixture. The certified value given below applies to the identified cylinder and NIST sample number.

Carbon Monoxide Mole Fraction: 2438.0 µmol/mol ± 5.1 µmol/mol[(a)]

Cylinder Number: SAMPLE
NIST Sample Number: SAMPLE
Hydrotest Date: June 2006
Blend Date: August 2006

[(a)] The certified value is expressed as $x \pm U_{95\%}(x)$, where x is the value and $U_{95\%}(x)$ is the expanded uncertainty of the value. The true value of the analyte lies within the interval $x \pm U_{95\%}(x)$ with 95 % confidence. For guidance in propagating this uncertainty, see reference 2.

Other Information: Appendix A lists information on other components in the mixture.

Period of Validity: The certified value delivered by **SRM 2637a Lot No. 56-F-XX** has an expiration date of **19 September 2029**. The certified value is nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified or the internal pressure drops below 0.7 MPa (100 psig).

Maintenance of Certified Values: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM at the time of purchase. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available free of charge through the NIST SRM website.

Carlos A. Gonzalez, Chief
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Steven J. Choquette, Director
Office of Reference Materials

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Storage: This SRM should be stored under normal laboratory conditions within the temperature range of 15 °C to 30 °C.

Cylinder and Gas Handling Information: NIST recommends the use of a high-purity, two-stage pressure regulator with a stainless-steel diaphragm and CGA-350 outlet to safely reduce the pressure and to deliver this mixture to the instrument. The regulator should be purged to prevent accidental contamination of the SRM by repeatedly (minimum three times) opening the valve and pressurizing the regulator, then closing the valve and releasing the pressure safely into a vent line. The certified value for this SRM is no longer valid after the internal pressure drops below 0.7 MPa (100 psig).

Mixture Preparation: The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor under contract to NIST. The specifications stipulate that each SRM mixture be identical in carbon monoxide concentration and stable with time.

Analytical Methods: Analyses of the carbon monoxide concentration for this lot of cylinders were conducted by intercomparing each cylinder mixture to a representative cylinder chosen from the lot, the lot standard (LS), using Thermal Conductivity Detection (GC/TCD). Assignment of the carbon monoxide concentration to the LS was accomplished by intercomparison to primary gravimetric standards using GC/TCD.

Homogeneity Analysis: Each of the carbon monoxide mixtures which comprise this SRM lot was compared to the LS using GC/TCD. A statistical analysis of the analytical results indicated that sample-to-sample carbon monoxide concentration differences were not statistically significant. This indicates that within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have identical carbon monoxide concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

Carbon Monoxide Concentration Value Assignment: The certified carbon monoxide concentration for this SRM lot was computed from the assigned concentration for the lot standard and the homogeneity analysis.

CAS Registry Numbers: This SRM is certified for carbon monoxide in nitrogen. The relevant CAS Registry numbers for these components are: carbon monoxide CAS Registry 630-08-0; nitrogen (balance gas) CAS Registry 7727-37-9.

NOTICE TO USERS

NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; U.S. Government Printing Office: Washington, DC (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Jan 2022).

[2] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement* (GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (2008); available at https://www.bipm.org/en/publications/guides (accessed Jan 2022); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Jan 2022).

[3] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at https://www.nist.gov/pml/special-publication-811 (accessed Jan 2022).

Certificate Revision History: 27 January 2022 (Change of expiration date; updated format; editorial changes); 01 August 2014 (Extension of certification period; editorial changes); 29 January 2008 (Original certificate date).

Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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APPENDIX A

Trace Components: Trace components in SRM 2637a Lot 56-F-XX include:

Carbon Dioxide: The mole fraction of carbon dioxide in this mixture is <1 µmol/mol. Carbon dioxide was detected using gas chromatography with flame ionization detection with methanation (GC/FID/Methanation); carbon dioxide CAS registry 124-38-9.

Water: The mole fraction of water in this mixture is <1 µmol/mol. Water was detected using Cavity Ringdown Spectroscopy (CRS); water CAS Registry 7732-18-5.

Methane: The mole fraction of methane in this mixture is <0.5 µmol/mol. Methane was detected using gas chromatography with flame ionization detection (GC-FID); methane CAS Registry 74-82-8.

Total Hydrocarbons expressed as Methane: The mole fraction of total hydrocarbons in this mixture is <0.3 µmol/mol. Total hydrocarbons expressed as methane was detected using a GC/FID; methane CAS Registry 74-82-8.

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