National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2640a

Carbon Monoxide in Nitrogen

(Nominal Amount-of-Substance Fraction 2 % mol/mol)

This certificate reports the certified values for Lot 53-C-XX.

This Standard Reference Material (SRM) is a primary gas mixture for which the amount-of-substance fraction, expressed as concentration [1], may be related to secondary working standards. The SRM is intended for the calibration of instruments used for carbon monoxide determinations and for other applications.

This SRM mixture is 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 0.73 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 Value: This SRM mixture has been certified for carbon monoxide concentration. The certified value given below applies to the identified cylinder and NIST sample number.

Carbon Monoxide Mass Fraction Concentration:	1.978 % mol/mol ± 0.011 % mol/mol
Cylinder Number: SAMPLE	NIST Sample Number: SAMPLE
Hydrotest Date: October 1996	Blend Date: December 1996

A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [2]. The uncertainty of the certified value includes the estimated uncertainties in the NIST standards, the analytical comparisons to the lot standard (LS), and the uncertainty of comparing the LS with each of the mixtures comprising this lot. The uncertainty is expressed as an expanded uncertainty $U = ku_c$ with u_c determined by experiment and a coverage factor $k = 2$. The true value for the carbon monoxide amount-of-substance fraction is asserted to lie in the interval defined by the certified value ± U with a level of confidence of approximately 95 % [3].

Expiration of Certification: The certification of **SRM 2640a Lot No. 53-C-XX** is valid, within the measurement uncertainty specified, until **30 July 2022**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Cylinder and Gas Handling Information"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

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 SRM 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. This SRM should not be used after the internal pressure drops below 0.7 MPa (100 psig). This SRM should be stored under normal laboratory conditions within the temperature range of 15 ºC to 30 ºC.

Overall direction and coordination of the technical work required for certification of this SRM were performed by F.R. Guenther of the NIST Chemical Sciences Division.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 15 September 2014
Certificate Revision History on Last Page

Robert L. Watters, Jr., Director
Office of Reference Materials

SAMPLE

Analytical measurements leading to the certification of the current SRM lot were performed by W.R. Miller and P.A. Johnson of the NIST Chemical Sciences Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Traceability: The measurand is the total concentration of carbon monoxide in nitrogen and the certified value is metrologically traceable to the SI unit of micromoles of carbon monoxide per total moles of carbon monoxide and nitrogen.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If significant changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

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 that 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 LS 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 CAS Registry 7727-37-9.

REFERENCES

[1] 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 http://www.nist.gov/pml/pubs/sp811/index.cfm (accessed Sep 2014).

[2] May, W.; Parris, R.; Beck, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements;* NIST Special Publication 260-136, U.S. Government Printing Office; Washington, DC (2000); available at http://www.nist.gov/srm/upload/SP260-136.PDF (accessed Sep 2014).

[3] 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 http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Sep 2014); 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 http://www.nist.gov/pml/pubs/index.cfm (accessed Sep 2014).

Certificate Revision History: 15 September 2014 (Extension of certification period; editorial changes); 13 March 2008 (Editorial correction to the fill date; extension of certification period); 15 July 2005 (Editorial correction to the units for the carbon monoxide concentration); 13 July 2005 (Extension of certification period); 04 December 2002 (Extension of certification period); 17 September 1997 (Original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.

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