National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1264a

High-Carbon Steel (Modified)
(disk form)

This Standard Reference Material (SRM) is a low alloy, high-carbon steel intended primarily for evaluation of methods for analysis of elements in steel alloys of similar composition. It can be used to validate value assignment of in-house reference materials. A unit of SRM 1264a consists of a disk that is 31 mm diameter and 19 mm thick.

Certified Mass Fraction Values: Certified values for constituents in SRM 1264a are provided in Table 1 as mass fractions of the total amounts of the elements in a steel [1]. 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 taken into account [2]. A certified value is the present best estimate of the true value. The certified values are metrologically traceable to the derived SI unit of mass fraction, expressed in percent (%). The uncertainty listed with each value is a combined standard uncertainty (not expanded), expressed at an approximate confidence level of 68 %, and calculated following the JCGM Guide [3].

Expiration of Certification: The certification of **SRM 1264a** is valid indefinitely, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Storage, Handling and Use"). Periodic recalibration or recertification of this SRM is not required. The certification is nullified if the SRM is damaged, contaminated or otherwise modified.

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

Coordination of technical measurements leading to certification was performed by K.F.J. Heinrich, O. Menis, B.F. Scribner, J.I. Schultz, and J.L. Weber. Additional technical support was provided by J.R. Sieber of the NIST Chemical Sciences Division.

Analytical measurements were performed by J.R. Baldwin, R.K. Bell, D.M. Bouchette, D.E. Brown, R.W. Burke, B.S. Carpenter, B.I. Diamondstone, T.E. Gills, G.J. Lutz, L.A. Machlan, L.T. McClendon, J. McKay, E.J. Maienthal, L.J. Moore, T.J. Murphy, J.A. Norris, P.J. Paulson, P.A. Pella, T.C. Rains, S.D. Rasberry, J.R. Sieber, B.A. Thompson, J.L. Weber, and S.A. Wicks of the NIST Chemical Sciences Division. Additional analyses were performed by collaborating laboratories, including G.A. Nahstoll, Ford Motor Co. (Dearborn, MI), F.T. Coyle, Kawecki Berylco Industries, Inc. (Boyertown, PA), and J.H. Morris and J. Scott, Lukens Steel Co. (Coatesville, PA).

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

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Table 1. Certified Mass Fraction Values for SRM 1264a High-Carbon Steel (Modified)

Elements	Mass Fraction (%)	Combined Standard Uncertainty (%)
Antimony (Sb)	0.034	0.001
Arsenic (As)	0.052	0.005
Carbon (C)	0.871	0.005
Calcium (Ca)	0.00004	0.00001
Cerium (Ce)	0.00022	0.00005
Chromium (Cr)	0.066	0.005
Cobalt (Co)	0.15	0.01
Copper (Cu)	0.250	0.005
Lanthanum (La)	0.00007	0.00001
Lead (Pb)	0.024	0.001
Magnesium (Mg)	0.00015	0.00001
Manganese (Mn)	0.258	0.005
Molybdenum (Mo)	0.49	0.01
Neodymium (Nd)	0.00007	0.00001
Nickel (Ni)	0.142	0.005
Niobium (Nb)	0.157	0.005
Phosphorus (P)	0.010	0.001
Silicon (Si)	0.067	0.001
Sulfur (S)	0.025	0.001
Tantalum (Ta)	0.11	0.01
Tellurium (Te)	0.00018	0.00001
Titanium (Ti)	0.24	0.01
Tungsten (W)	0.102	0.005
Vanadium (V)	0.106	0.005
Zirconium (Zr)	0.069	0.001

INSTRUCTIONS FOR STORAGE, HANDLING AND USE

The test surface is the side opposite to the labeled surface, which has the SRM number. The entire thickness of the unit is certified. Each packaged disk has been prepared by finishing the test surface using a milling machine. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface. The material should be stored in its original container in a cool, dry location.

NOTICE: The presence of titanium/niobium inclusions in SRM 1264a is known to cause biases in X-ray fluorescence measurements of solid alloy specimens. Using XRF, the certified values for Ti and Nb will not be obtained from a calibration based on alloys that do not have Ti/Nb inclusions to the same extent as SRM 1264a.

PREPARATION, TESTING, AND ANALYSIS[(1)]

The material for SRM 1264a was vacuum melted and cast at the Carpenter Technology Corp. (Reading, PA). The contract was made possible by a grant from the American Iron and Steel Institute (Washington, DC). The ingots were processed to provide material of the highest possible homogeneity and supplied to NIST in the form of rods. Following acceptance of the composition based on NIST analyses, selected portions of the ingot material were extensively tested for homogeneity at NIST. Only material meeting a critical evaluation was processed to the final size. Chemical Analyses for certification were made on composite samples representative of the accepted lot of material.

[(1)] Certain commercial equipment, instruments or materials are identified in this certificate 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.

ADDITIONAL CONSTITUENTS: Noncertified values are provided for the following additional constituents in SRM 1264a.

Information Mass Fraction Values: Information values for constituents of SRM 1264a are reported in Table 2 as mass fractions pf the total elements in a steel matrix. An information value is a value that may be of interest to the SRM user, but insufficient information is available to assess the uncertainty associated with the value [2]. Information values cannot be used to establish metrological traceability.

Table 2. Information Values for SRM 1264a High-Carbon Steel (Modified)

Elements	Mass Fraction (%)	Elements	Mass Fraction (%)
Aluminum (Al)	0.008	Nitrogen (N)	0.0032
Bismuth (Bi)	0.0009	Oxygen (O)	0.0010
Boron (B)	0.011	Praseodymium (Pr)	0.00003
Germanium (Ge)	0.003	Selenium (Se)	0.00021
Gold (Au)	0.0001	Silver (Ag)	0.00002
Hafnium (Hf)	0.0013	Strontium (Sr)	0.0005
Hydrogen (H)	< 0.0005	Tin (Sn)	0.008
Iron (Fe)	96.7	Zinc (Zn)	0.001

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] 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://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication811e2008.pdf (accessed Feb 2019).

[2] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136 (2000); available at https://www.nist.gov/sites/default/files/documents/srm/SP260-136.PDF (accessed Feb 2019).

[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 (JCGM) (2008); available at https://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Feb 2019); 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 Feb 2019).

Certificate Revision History: 22 February 2019 (Change of Gold value from certified to information; editorial changes); 20 September 2006 (This revision corrects the certified values for S, Si, and V); 07 April 2006 (Editorial changes); 20 January 1988 (Original certificate date).

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: telephone (301) 975-2200; fax (301) 948-3730, email srminfo@nist.gov; or via the Internet at https://www.nist.gov/srm.