National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1768

High-Purity Iron
(disk form)

This Standard Reference Material (SRM) is intended primarily for use in validation of chemical and instrumental methods of analysis of iron and ferrous alloys. It can be used to validate value assignment of in-house reference materials. A unit of SRM 1768 consists of a disk of high-purity iron approximately 31 mm in diameter and 19 mm thick.

Certified Mass Fraction Values: Certified values for constituents of SRM 1768 are reported in Table 1 as mass fractions of the elements in iron [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 SI derived unit of mass fraction expressed as percent (%). The uncertainty estimates are defined as combined standard uncertainties (not expanded), and are expressed at a confidence level of approximately 68 %.

Table 1. Certified Mass Fraction Values for SRM 1768 High-Purity Iron

Constituent	Mass Fraction (%)	Combined Standard Uncertainty (%)
Aluminum (Al)	0.0024	0.0003
Carbon (C)	0.0010	0.0002
Cobalt (Co)	0.0025	0.0004
Copper (Cu)	0.0006	0.0001
Manganese (Mn)	0.0014	0.0005
Nickel (Ni)	0.0014	0.0004
Nitrogen (N)	0.002	0.001
Oxygen (O)	0.036	0.003
Phosphorus (P)	0.0013	0.0004
Sulfur (S)	0.0003	0.0001

Expiration of Certification: The certification of **SRM 1768** is valid indefinitely, within the uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). Periodic 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 before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of the technical measurements leading to certification was performed under the direction of J.I. Shultz, Research Associate, ASTM/NIST Research Associate Program.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 19 July 2017
Certificate Revision History on Last Page

Steven J. Choquette, Director
Office of Reference Materials

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

INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

The test surface is the side opposite from the labeled surface, which includes the SRM number. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. 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. It was found by NIST that abrasive paper must be changed frequently during surface grinding. Used paper loses its ability to remove contaminants from the surface of the steel. When not in use, the material should be stored in its original container in a cool, dry location. This material was tested using both the solid disks and chips prepared from the disks. The certified values are considered to be representative of the overall average composition of the material.

ADDITIONAL CONSTITUENTS: Noncertified values are provided for the following additional constituents in SRM 1768.

Information Values: Information values for constituents in SRM 1768 are reported in Table 2. 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 Mass Fraction Values for SRM 1768 High-Purity Iron

Constituent	Mass Fraction (µg/g)	Constituent	Mass Fraction (µg/g)
Antimony (Sb)	< 1	Selenium (Se)	< 1
Arsenic (As)	< 1	Silicon (Si)	< 10
Bismuth (Bi)	< 4	Tantalum (Ta)	< 1
Boron (B)	< 2	Tellurium (Te)	< 1
Cadmium (Cd)	< 1	Tin (Sn)	< 1
Calcium (Ca)	< 1	Titanium (Ti)	< 10
Chromium (Cr)	< 2	Tungsten (W)	< 2
Lead (Pb)	< 1	Vanadium (V)	< 1
Magnesium (Mg)	< 6	Zinc (Zn)	< 1
Molybdenum (Mo)	< 3	Zirconium (Zr)	< 1
Niobium (Nb)	< 5		

PREPARATION AND ANALYSIS[(1)]

The material for SRM 1768 was provided under a contract with T.R. Linde. Homogeneity testing was performed at NIST by J.A. Norris (retired). The analytical methods used for determination of each constituent are listed in Table 3.

Analyses leading to the certification of SRM 1768 were performed at NIST. Analytical determinations were also performed by B. Berglund, AB Sandvik Steel, Sandviken, Sweden; C.K. Deak, Analytical Associates, Inc., Detroit, MI, F.A. Pennington, Jr., R.F. Eakin, J.E. Fickel, M.P. Royer, and S.M. Goldinger, Andrew S. McCreath & Son, Inc., Harrisburg, PA; C.C. Borland, D.E. Gillum, H.P. Vail, G.D. Smith, G.R. Doebler, and T.M. Minor, Armco Research & Technology, Middletown, OH; H. Umans, Hoogovens Groep BV, Ijmuiden, Netherlands; C.L. Maul, E.W. Hobart, and E.P. Kehoe, Ledoux & Co., Teaneck, NJ; L.W. Ollila, Luvak, Inc., Boylston, MA; and S. Kasai and M. Saeki, Nippon Steel Corporation, Kawasaki, Japan

[(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.

Table 3. Analytical Method Used for Value Assignment

Element	Method
Aluminum	Atomic Absorption Spectrometry (AAS), Inductively Coupled Plasma Optical Emission Spectrometry (ICPOES), DC Plasma Optical Emission Spectrometry (DCPOES), Spark Source Mass Spectrometry (SSMS)
Carbon	Combustion-Infrared Detection, Combustion-Conductimetry
Cobalt	AAS, ICPOES, DCPOES, SSMS
Copper	AAS, ICPOES, DCPOES, SSMS
Manganese	AAS, ICPOES, DCPOES, SSMS
Nickel	AAS, ICPOES, DCPOES, SSMS
Nitrogen	Spectrophotometry, Combustometric
Oxygen	Combustometric
Phosphorus	AAS, ICPOES, DCPOES, SSMS, Spectrophotometry
Sulfur	Combustion-Infrared Detection, Spectrophotometry, Combustion-Titrimetry

REFERENCE

[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://www.nist.gov/physical-measurement-laboratory/special-publication-811 (accessed July 2017).

[2] May, W.E.; Parris, R.M.; Beck II, C.M.; Fassett, J. D.; Greenberg, R.R.; Guenther, F.R.; Kramer, G.W.; Wise, S.A.; Gills, T.E.; Colbert, J.C.; Gettings, R.J.; MacDonald, B.S.; *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Spec. Pub. 260-136, U.S. Government Printing Office, Washington, DC, (2000); available at https://www.nist.gov/sites/default/files/documents/srm/SP260-136.PDF (accessed July 2017).

Certificate Revision History: 19 July 2017 (Updated title; editorial changes); 25 October 2011 (Corrected units in Table 2 from mg/g to µg/g; editorial changes); 05 October 2000 (Corrected disk diameter; editorial changes.); 06 December 1991 (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 SRM Program at: telephone (301) 975-2200; fax (301) 948-3730, email srminfo@nist.gov; or via the Internet at http:/www.nist.gov/srm.