National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 363

Chromium-Vanadium Steel (Modified)

This Standard Reference Material (SRM) is intended primarily for use in chemical methods of analysis. SRM 363 is in the form of chips sized between 0.5 mm and 1.18 mm sieve openings (35 mesh and 16 mesh).

The certified values for 27 elements are listed in Table 1; information values for 14 additional elements are listed in Table 2. For all elements, values are reported as mass fractions [1]. The uncertainties for all elements, with the exception of boron, reflect the guidance given in NBS Monograph 148 [2]. The uncertainty for boron is assessed according to the ISO Guide [3].

Table 1. Certified Values for SRM 363

Element	Composition mass fraction (in %)			Element	Composition mass fraction (in %)		
Aluminum (total)	0.24	±	0.01	Molybdenum	0.028	±	0.001
Antimony	0.002	±	0.001	Neodymium	0.0012	±	0.0001
Arsenic	0.010	±	0.001	Nickel	0.30	±	0.01
Calcium	0.00022	±	0.00005	Niobium	0.049	±	0.001
Carbon	0.62	±	0.01	Phosphorus	0.029	±	0.005
Cerium	0.0030	±	0.0001	Silicon	0.74	±	0.01
Chromium	1.31	±	0.01	Silver	0.0037	±	0.0001
Cobalt	0.048	±	0.001	Sulfur	0.0068	±	0.0002
Copper	0.10	±	0.01	Tin	0.104	±	0.005
Gold	0.0005	±	0.0001	Titanium	0.050	±	0.001
Lead	0.00186	±	0.00005	Tungsten	0.046	±	0.001
Magnesium	0.00062	±	0.00005	Vanadium	0.31	±	0.01
Manganese	1.50	±	0.01	Zirconium	0.049	±	0.001
Boron	13.10 mg/kg ± 0.37 mg/kg						

Certified Values and Uncertainties: The certified values for boron and sulfur were determined by thermal prompt gamma activation analysis and isotope dilution spark source mass spectrometry at NIST, respectively. The boron value was confirmed using isotope dilution inductively coupled plasma mass spectrometry and inductively coupled plasma optical emissions spectrometry by Coedo et al. [4], and the sulfur value was confirmed using isotope dilution mass spectrometry data provided by the Japan Atomic Energy Research Institute (JAERI). The expanded uncertainty for boron is calculated as $U = ku_c$, where u_c is intended to represent at the level of one standard deviation, the combined effect of uncertainty components associated with the measurements and with element inhomogeneity. The coverage factor, $k = 2$, is determined from the Student's t-distribution with 7.0 degrees of freedom and corresponds to an approximate 95 % confidence interval. The other elements were measured at NIST and the cooperating laboratories using a variety of chemical methods. The certified values and uncertainties for these elements are the present best estimates of the true values based on the results of the cooperative analytical program.

Expiration of Certificate: The certification of **SRM 363** is valid indefinitely, within the uncertainty specified. Accordingly, 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) will facilitate notification.

Stephen A. Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 03 April 2012
Certificate Revision History on Last Page

Robert L. Watters, Jr., Chief
Measurement Services Division

The overall direction and coordination of the original technical measurements leading to certification were performed under the direction of O. Menis, B.F. Scribner, J.I. Shultz, and J.L. Weber, Jr., of the NIST Analytical Chemistry Division. Coordination of the boron measurements leading to certification was performed by R.R. Greenberg and R.M. Lindstrom of the NIST Analytical Chemistry Division.

The original chemical analyses were performed by R.K. Bell, R.W. Burke, T.E. Gills, E.J. Maienthal, L.T. McClendon, T.C. Rains, T.A. Rush, B.A. Thompson, and S.A. Wicks of the NIST Analytical Chemistry Division. Prompt gamma neutron activation analyses were performed by R.M. Lindstrom of the NIST Analytical Chemistry Division.

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by R.E. Michaelis. Revision of this certificate was coordinated through the NIST Standard Reference Materials Program by C.R. Beauchamp.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Table 2. Information Values

Element	Composition mass fraction (in %)	Element	Composition mass fraction (in %)
Bismuth	0.0008	Oxygen	0.00066
Germanium	0.010[a]	Praseodymium	0.0004
Hafnium	0.0005	Selenium	0.00016
Hydrogen	<0.0005	Strontium	<0.0005
Iron (by difference)	94.4	Tantalum	0.053
Lanthanum	0.002	Tellurium	0.0009
Nitrogen	0.0041	Zinc	0.0004

[a] Approximate value from heat analysis

Technical Contacts and Participating Laboratories:

J.W. Mann and H.E. Trapp, Climax Molybdenum Company of Michigan, Ann Arbor, MI
W.L. MacBride, Midvale-Heppenstall Company, Nicetown, Philadelphia, PA
J. Metzger, Standard Steel Company, Burnham, PA
O.P. Bhargava, The Steel Company of Canada, Hamilton, Ontario, Canada

PREPARATION, TESTING, AND ANALYSIS[1]

The material for this standard was vacuum melted and cast, under contract, by the Carpenter Technology Corporation, Reading, PA, to provide material of the highest possible homogeneity. The contract was made possible by a grant from the American Iron and Steel Institute (AISI). Following acceptance of the material, selected portions of the ingots were extensively tested for homogeneity by D.M. Bouchette, S.D. Rasberry, and J.L. Weber, Jr., of the NIST Analytical Chemistry Division. Certification analyses were made on composite samples. However, for certain elements and based on previous experience, only one composite sample was analyzed with the results applied to the other forms of the 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.

REFERENCES

[1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).

[2] Cali, J.P. et al, "The Role of Standard Reference Materials in Measurement Systems," NBS Monograph 148, p. 21, (1975).

[3] *Guide to the Expression of Uncertainty of Measurement*, ISBN 92-67-10188-9, 1st Ed., ISO, Geneva, Switzerland, (1993); see also Taylor, B.N. and 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 Apr 2012).

[4] Coedo, A.G.; Dorado, T.; Fernandez, B.J., and Alguacil, F.J.; "Isotope Dilution Analysis for Flow Injection ICPMS Determination of Microgram per Gram Levels of Boron in Iron and Steel after Matrix Removal," Analytical Chemistry; 68, pp. 991–996, (1996).

Certificate Revision History: 03 April 2012 (Tantalum information value corrected; editorial changes); **29 May 2001** (This revision reflects the addition of a new boron value and editorial changes); **26 March 1996** (This revision reflects the removal of the boron value and editorial changes); **24 February 1981** (This revision reflects a change in the certified sulfur value); **8 January 1976** (This revision reflects the addition of seventeen certified elements); **30 September 1970** (Originally issued as a provisional certificate).

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