National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 1766

Low Alloy Steel

(In Cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of a disk, approximately 34 mm (1 3/8 in) in diameter and 19 mm (3/4 in) thick, and is intended for use in optical emission and X-ray spectrometric methods of analysis.

Element	Certified Value[1] % by Wt.	Estimated[2] Uncertainty
Carbon	0.015	0.001
Manganese	0.067	0.002
Phosphorus	0.002	0.001
Sulfur	0.0024	0.0002
Silicon	0.010	0.005
Copper	0.015	0.001
Nickel	0.021	0.002
Chromium	0.024	0.001
Vanadium	0.009	0.001
Molybdenum	0.0035	0.0005
Titanium	0.0005	0.0002
Cobalt	0.0020	0.0005
Tin	0.0010	0.0005
Aluminum	0.012	0.002
Niobium	0.005	0.001
Arsenic	0.0035	0.0005
Lead	0.003	0.001
Antimony	0.0005	0.0002
Silver	0.0005	0.0001
Boron	0.00012	0.00006
Nitrogen	0.0033	0.0003

[1]The certified value listed for a constituent is the present best estimate of the "true" value based on the results of the cooperative program for certification.

[2]The estimated uncertainty listed for a constituent represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability and is based on judgment. No attempt is made to derive exact statistical measures of imprecision because several methods were used in the determination of most constituents.

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

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by P.A. Lundberg.

Gaithersburg, MD 20899
February 26, 1993
(Revision of certificate dated 6-5-89)

William P. Reed, Chief
Standard Reference Materials Program

(over)

SUPPLEMENTAL INFORMATION

Atomic emission and X-ray spectrometric homogeneity test results showed the following standard deviations of the mean (1 σ) for this SRM. Values are given in percent. These standard deviations are attributed to both material and instrumental variability and are method specific.

Standard Deviation of the Mean

Element	Atomic Emission[3]	X-ray[4]
Carbon	0.0016	---
Manganese	0.00098	0.0010
Phosphorus	0.00073	0.00018
Sulfur	0.00014	0.00030
Silicon	0.00034	---
Copper	0.00079	0.00075
Nickel	0.00047	0.00084
Chromium	0.0013	0.00052
Vanadium	0.00034	0.00013
Molybdenum	0.00029	0.00016
Cobalt	0.00031	---
Titanium	0.00017	0.00009
Aluminum	0.0018	0.00077
Tin	0.0013	---
Zirconium	0.00071	---
Niobium	0.00063	0.00038
Boron	0.00008	---

[3]ASTM Method E415-85.
[4]ASTM Method E322-67 (1985).

Elements other than those certified may be present in this material as indicated below. These are not certified, but are given as additional information on the composition.

Element	Concentration, % by Wt.
Zirconium	(0.0004)
Bismuth	(<0.0001)
Magnesium	(<0.0005)
Selenium	(0.0035)
Tellurium	(0.003)
Tungsten	(0.001)
Cerium	(0.002)
Tantalum	(0.006)

PLANNING, PREPARATION, TESTING, ANALYSIS

The material for this standard was vacuum induction melted followed by vacuum arc remelting at the Carpenter Technology Corporation, Reading, PA, under a contract with the NIST. The ingots were processed by Carpenter Technology Corporation to provide material of high homogeneity.

Following acceptance of the composition based on analyses at NIST, selected portions of the ingot material were extensively tested for homogeneity at NIST by J.A. Norris and D.E. Brown. Only that material meeting a critical evaluation was processed to the final size. The final material was tested for homogeneity by atomic emission and X-ray spectrometry at NIST.

Cooperative analyses for certification were performed in the following laboratories:

Allegheny Ludlum Steel Corporation, Technical Center, Brackenridge, PA, W.D. Heavner, C.C. Gabrielli and J.L. Powell.

Analytical Associates, Inc., Detroit, MI, C.K. Deak.

Bethlehem Steel Corporation, Sparrows Point, MD, P. Sells.

General Motors Research Laboratories, Warren, MI, N.M. Potter, M.P. Balogh, and R.L. Passeno.

National Steel Corporation, Granite City Division, Granite City, IL, B. McKee and D. Schmidt.

National Institute of Standards & Technology, Inorganic Analytical Research Division, R.W. Burke, L.E. Creasy, W.F. Koch, A.F. Marlow, P.A. Pella, M.V. Smith, T.W. Vetter, Xie Guirong, and Xu Fu Zheng.

The Timken Company, Canton, OH, N.J. Stecyk.

Central Bureau for Nuclear Measurements, Geel, Belgium, A. Lamberty, L. Van Nevel, and P. DeBievre.

Note: Data for nitrogen was provided by AISI's Technical Committee on Chemical Analysis, courtesy of D.E. Gillum, ARMCO Research Technology.

The following laboratories participated in the testing program:

Acme Steel Company, Riverdale, IL, V. Beaucaire, D. Bekeza.

Algoma Steel Corporation, Sault Ste. Marie, Ontario, Canada, J. DeJong, J. Gale.

Armco Research & Technology, Middletown, OH, D.E. Gillum, T. Minor.

Armco Steel Company, Ashland, KY, R. Peterson, G. Richardson, E. Connelly, T. Scherer.

Bethlehem Steel Corporation, Steelton, PA, D. Vares.

Lukens Steel, Coatesville, PA, J. Morris, S. Forese.

Mc Louth Steel, Trenton, MI, M. Wiers, D. Robillard.

Inland Steel, East Chicago, IN, R. Hawkins.

Wheeling-Pittsburgh Steel, Steubenville, OH, B. Fazio, G. Wayt.

Dofasco Steel, Hamilton, Ontario, Canada, R. Dalrymple, K. Barker.