National Institute of Standards & Technology

Certificate

Standard Reference Material 1761

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	1.03	0.01
Manganese	0.678	0.005
Phosphorus	0.040	0.001
Sulfur	0.035	0.002
Silicon	0.18	0.01
Copper	0.30	0.01
Nickel	1 99	0.01
Chromium	0.220	0.005
Vanadium	0.053	0.002
Molybdenum	0.103	0.002
Titanium	0.18	0.01
Arsenic	0.011	0.002
Aluminum (total)	0.055	0.005
Niobium	0.021	0.001
Zirconium	0.013	0.001
Boron	0.0020	0.0001
Nitrogen	0.0044	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
April 23, 1992
(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 sigma) 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	0.0095	---
Manganese	0.0037	0.0027
Phosphorus	0.0010	0.0024
Sulfur	0.0011	0.0006
Silicon	0.0019	---
Copper	0.0027	0.0016
Nickel	0.0103	0.0076
Chromium	0.0019	0.0011
Vanadium	0.00086	0.0003
Molybdenum	0.0013	0.0004
Titanium	0.0082	0.0007
Arsenic	0.0016	---
Aluminum	0.0012	0.0018
Niobium	0.0015	0.0005
Zirconium	0.0007	---
Boron	0.0001	---
Cobalt	0.0004	0.002
Tantalum	0.0053	---
Tin	0.0018	---

[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 Weight
Antimony	(0.005)
Cobalt	(0.028)
Tantalum	(0.05)
Tin	(0.05)
Iron	(95.3)

PLANNING, PREPARATION, TESTING, ANALYSIS:

The material for this standard was vacuum induction melted followed by vacuum arc remelting at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Institute of Standards & Technology.

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:

--Amax Research & Development Center, Golden, Colorado, R.C. Birns.

--American Cast Iron Pipe Company, Birmingham, Alabama, R.N. Smith, D.R. Denney, C.E. Meads, R.J. Huffman, J.M. Hudson, and R.G. Moffett.

--Armco Research & Technology, Middletown, Ohio, C.C. Borland, M.D. Kaehler, J.W. Leeker, T.M. Minor, G.D. Smith, R.L. Swigert, H.P. Vail, S.B. Warman, and B.J. Young.

--Carpenter Technology Corporation, Carpenter Steel Division, Reading, Pennsylvania, T.R. Dulski.

--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, Ohio, 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, Illinois, V. Beaucaire, D. Bekeza.

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

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

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

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

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

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

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

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

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