U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards Certificate of Analysis

Standard Reference Material 664

High-Carbon Steel (Modified)

This standard is in the form of rods 3.2 mm (1/8 in) in diameter and 51 mm (2 in) long for application in microchemical methods of analysis such as electron probe microanalysis, spark source mass spectrometric analysis, and laser probe analysis.[a]

Element	Percent, by weight	Element	Percent, by weight
Carbon	0.87_1	Tungsten	0.10_2
Manganese	$.25_8$	Cobalt	.15
Phosphorus	.010	Titanium	.23
Sulfur	.025	Arsenic	$.05_2$
Silicon	.066	Niobium	$.15_7$
Copper	$.25_0$	Tantalum	.11
Nickel	$.14_2$	Boron	.011
Chromium	$.06_6$	Lead	.024
Vanadium	$.10_6$	Zirconium	.069
Molybdenum	.49	Gold	.0001
		Lanthanum	.00007

[a]This material also is available in the form of disks, SRM 1264, 31 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick for use in optical emission and x-ray spectrometric analysis; chips, SRM 364, for use in chemical methods of analysis; and will be available in the form of rods, SRM 1098, 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long for the determination of gases in metals by vacuum fusion and neutron activation methods of analysis.

ANALYTICAL CERTIFICATION: The value listed for a certified element is the present best estimate of the "true" value based on the results of the analytical program. The value listed is not expected to deviate from the "true" value by more than ± 1 in the last significant figure reported; for a subscript figure, the deviation is not expected to be more than ± 5. Based on the results of homogeneity testing, maximum variations within and among samples are estimated to be less than the uncertainty figures given above.

This standard contains unusually large amounts of carbon and carbide forming elements and contains segregates as shown by metallographic techniques and electron probe analysis. The usefulness of this standard for methods such as electron probe analysis is presently being investigated and will be reported later in detail.

Details of micro-homogeneity studies of this SRM, as well as other NBS SRM's are described in NBS Misc. Publ. 260-65, Standard Reference Materials: Micro-Homogeneity Studies of NBS Standard Reference Materials, NBS Research Materials, and Other Related Samples, R.B. Marinenko, K.F.J. Heinrich, and F.C. Ruegg, September 1979.

Washington, D.C. 20234
October 1, 1981
(Revision of Certificates dated
6/16/71, 8/15/72, & 2/12/73)

George A. Uriano, Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, ANALYSIS: This standard is one of five replacements for the original eight 1100 series iron and steel SRM's. Material from the same melt is available in a variety of forms to serve in checking methods of analysis and in calibrating instrumental techniques.

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D. M. Bouchette, S. D. Rasberry, and J. L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final sizes.

Chemical analyses for certification were made on composite samples representative of the accepted lot of material.

Cooperative analyses for certification were performed in the analytical laboratories of Ford Motor Co., Dearborn, Michigan, G. A Nahstoll; Kawecki Berylco Industries, Inc., Boyertown, Pennsylvania, F. T. Coyle; and Lukens Steel Co., Coatesville, Pennsylvania, J. H. Morris and J. Scott.

Analyses were performed in the Analytical Chemistry Division of the National Bureau of Standards by the following: J. R. Baldwin, R. K. Bell, R. W. Burke, D. M. Bouchette, B. S. Carpenter, T. E. Gills, G. J. Lutz, L. A. Machlan, E. J. Maienthal, L. T. McClendon, J. McKay, L. J. Moore, T. J. Murphy, P. J. Paulsen, S. D. Rasberry, B. A. Thompson, J. L. Weber, Jr., and S. A. Wicks.

The overall direction and coordination of the technical measurements at NBS leading to certification were performed under the direction of K. F. J. Heinrich, O. Menis, B. F. Scribner, J. I. Shultz, and J. L. Weber, Jr.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R. E. Michaelis.

ADDITIONAL INFORMATION ON THE COMPOSITION: Analytical certification is made only for the elements indicated. The five replacements, however, contain a graded series for 40 elements and information on the elements not initially certified may be of importance in the use of the material. Although these are not certified, values are presented in the following table for the remaining elements. (Some may be certified at a later date.)

Value from a single method of analysis:

Element	Percent, by weight
Aluminum (total)	(0.008)
Antimony	(.035)
Bismuth	(.0009)
Silver	(.00002)
Calcium	(<.0001)
Magnesium	(.0001)
Cerium	(.00025)
Neodymium	(.00012)
Praseodymium	(.00003)
Iron (by difference)	(96.7)

Approximate value from heat analysis:

Tin	[0.005]
Selenium	[.0003]
Tellurium	[.0002]
Hafnium	[.005]
Nitrogen	[.003]
Oxygen	[.0017]
Hydrogen	[<.0005]
Germanium	[.003]
Zinc	[.001]