National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 132b

Tool Steel (AISI M2)

This Standard Reference Material (SRM) is in the form of chips and is intended for use in checking chemical methods of analysis. A similar chemical composition material, also, is available in disk form as SRM 1157, for application in optical emission and x-ray spectrometric methods of analysis.

The certified values for twelve elements are listed in Table 1. The values obtained by individual analysts and the methods/techniques they used, are listed in Table 2. All values are reported as mass fractions [1].

Table 1. Certified Mass Fractions (w_B) and Uncertainties

Element	w_B (in %)	Element	w_B (in %)
Carbon	0.864 ± 0.005	Nickel	0.23 ± 0.01
Manganese	0.341 ± 0.005	Chromium	4.38 ± 0.01
Phosphorus	0.012 ± 0.001	Vanadium	1.83 ± 0.01
Sulfur	0.004 ± 0.001	Molybdenum	4.9 ± 0.1
Silicon	0.185 ± 0.005	Tungsten	6.28 ± 0.01
Copper	0.088 ± 0.001	Cobalt	0.029 ± 0.001

The certified values are the means of the results from three or more analytical methods. The uncertainties listed for the certified values include material inhomogeneity, measurement errors, and possible bias between laboratories. They are the present best estimates of the true values based on the results of the cooperative analytical program [2].

The material for this standard was prepared by the Carpenter Technology Corp., Reading, PA.

Cooperative analyses for certification were performed in the following laboratories:

1. NIST Analytical Chemistry Division; R.K. Bell, S.A. Wicks, and E.R. Deardorff
2. Carpenter Technology Corp., Reading, PA; A.L. Sloan
3. Ledoux and Company, Teaneck, NJ.; S. Kallman
4. Bethlehem Steel Corporation, Sparrows Point, MD.; F.G. Fick, and W. Selig

The overall direction and coordination of the preparation and technical measurements leading to the certification of this SRM were performed by O. Menis and J.I. Shultz of the NIST Analytical Chemistry Division.

The technical and support aspects involved in the original certification and issuance of this SRM were coordinated through the Standard Reference Materials Program by R.E. Michaelis. Revision of this certificate was coordinated through the Standard Reference Materials Program by P.A. Lundberg

This Certificate of Analysis has undergone editorial review to reflect program and organizational changes at NIST and the Department of Commerce. No attempt was made to reevaluate the certificate values or any other technical data presented on this certificate.

Gaithersburg, MD 20899
August 15, 1995
(Revision of certificate dated 8-16-73)

Thomas E. Gills, Chief
Standard Reference Materials Program

Table 2. Individual Analyst Values

Element	w_B (in %) Analyst 1	Analyst 2	Analyst 3	Analyst 4
Carbon	0.863[a]	0.863[b]	0.861[b]	0.867[a]
Manganese	0.340[c]	0.340[c]	0.339[w]	0.346[c]
		0.338[d]		
Phosphorus		0.011[e]	0.012[e]	0.012[f]
Sulfur	0.006[g]	0.003[h]	0.005[x]	0.004[x]
		0.004[h]		
Silicon	0.181[i]	0.195[j]	0.184	0.180[j]
Copper		0.090[k]	0.088	0.087[l]
		0.087[d]		
Nickel	0.231[m]	0.227	0.233	0.228
Chromium	4.38[n]	4.38[n]	4.37[o]	4.39[o]
Vanadium	1.86[p]	1.82[p]	1.83	1.81
Molybdenum	4.87[q]	4.94[q]	4.91[q]	4.90[r]
Tungsten	6.28[s]	6.26[s]	6.28[s]	6.29[t]
Cobalt		0.028[u]	0.030[d]	0.027[v]
		0.030[d]		

Individual Methods/Techniques Used

[a] Combustion chromatographic method.
[b] Combustion gravimetric method.
[c] Periodate spectrophotometric method.
[d] Atomic absorption spectrometry.
[e] Molybdenum blue spectrophotometric method.
[f] Alkalimolybdate method.
[g] 1-g sample burned in oxygen at 1450 °C and sulfur dioxide absorbed in starch iodide solution. Iodine is liberated
from iodide by titration with standard $KI0_3$ solution.
[h] Combustion spectrophotometric method using pararosaniline.
[i] Double dehydration with perchloric acid.
[j] Double dehydration with perchloric and sulfuric acids.
[k] 2-2' biquinoline spectrophotometric method.
[l] Neocuproine spectrophotometric method.
[m] Dimethylglyoxime spectrophotometric method.
[n] Persulfate oxidation, potentiometric titration with standard ferrous ammonium sulfate solution.
[o] Persulfate oxidation, $FeSO_4$-$KMnO_4$ titration method.
[p] Nitric acid oxidation, potentiometric titration with standard ferrous ammonium sulfate solution.
[q] Ion-exchange, benzoinoxime, $Mo0_3$ gravimetric method.
[r] H_2S, alpha-benzoinoxime gravimetric method.
[s] Ion-exchange, cinchonine, WO_3 gravimetric method.
[t] Acid digestion, cinchonime, WO_3 gravimetric method.
[u] Tetraphenylarsonium chloride spectrophotometric method.
[v] Nitroso-R spectrophotometric method.
[w] Persulfate-arsenite titration method.
[x] Combustion titration method.

REFERENCE

[1] Taylor, B.N., Guide to 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, (January 1975).