National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 133b

Chromium-Molybdenum Steel

(In cooperation with ASTM International)

This Standard Reference Material (SRM) is intended primarily for use in evaluating chemical and instrumental methods of analysis. A unit of SRM 133b consists of a bottle containing approximately 150 g of fine millings sized between 0.50 mm (No. 35 sieve) and 1.18 mm (No. 16 sieve).

Certified Mass Fraction Values: The certified values, expressed in percent, are metrologically traceable to the SI unit of mass [1]. The certified mass fraction values for elements in SRM 133b are listed in Table 1. A NIST certified value is the present best estimate of the "true" value based on the results of analyses performed at NIST and collaborating laboratories using the test methods listed in Table 3.

Information Mass Fraction Values: Information mass fraction values are provided in Table 2. An information value is considered to be a value that will be of interest to the SRM user, but insufficient information is available to assess the uncertainty associated with the value. Information values cannot be used to establish metrological traceability. In this case, the information values were reported by one of the collaborating laboratories.

Expiration of Certification: The certification of **SRM 133b** is valid indefinitely, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Use"). 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 or register online) will facilitate notification.

Coordination of the technical measurements leading to certification was performed under the direction of J.I. Shultz, Research Associate, ASTM/NIST Research Associate Program. Analytical measurements for stability testing of this SRM were performed by J.R. Sieber and A.F. Marlow of the NIST Chemical Sciences Division.

Measurements for value assignment of SRM 133b were performed by B.I. Diamondstone of the NIST Chemical Sciences Division and by R.K. Bell, Assistant Research Associate, ASTM/NIST Research Associate Program. Analyses for certification were also performed by R.W. Jones and B.G. Brainard, Republic Steel Corporation, central Alloy District, Canton, OH; L.M. Melnick, H.S. Karp, H.R. Frisbie, D.G. Glaser and F.T. Hornak, United States Steel Corporation, Research Laboratory, Monroeville, PA; F.F. Liberato, D. McGlone and M. Pardus, Universal-Cyclops Specialty Steel Division, Cyclops Corporation, Bridgeville Plant, Bridgeville, PA; R. Hall, Universal-Cyclops Specialty Steel Division, Cyclops Corporation, Titusville Plant, Titusville, PA.

Statistical consultation for stability testing this SRM was provided by J.H. Yen of the NIST Statistical Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

Carlos A, Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Revision Date: 22 September 2014
Certificate Revision History on Last Page

Robert L. Watters, Jr, Director
Office of Reference Materials

INSTRUCTIONS FOR USE

To relate analytical determinations to the certified values on this Certificate of Analysis, a minimum sample quantity of 500 mg is recommended. The millings do not require preparation prior to weighing and dissolution. The material should be stored in its original container in a cool, dry location.

PLANNING, PREPARATION, TESTING, AND ANALYSIS[1]

The material for this SRM was provided by the Republic Steel Corporation through the courtesy of R.W. Jones.

Homogeneity testing was performed at NIST by J.A. Norris, B.I. Diamondstone, and R.K. Bell, Assistant Research Associate, ASTM/NIST Research Associate Program.

Certified Mass Fraction Values: Certified mass fraction values are listed in Table 1. The combined uncertainty listed with the value is an estimate based on a 67 % confidence interval [2] and represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability. The certified values, expressed in percent, are metrologically traceable to the SI unit of mass.

Table 1. Certified Mass Fraction Values for SRM 133b Chromium-Molybdenum Steel

Constituent	Mass Fraction (%)	Combined Uncertainty (Mass Fraction %)
C	0.128	0.002
Mn	1.07	0.02
P	0.018	0.002
S	0.328	0.004
Si	0.327	0.006
Cu	0.080	0.003
Ni	0.230	0.004
Cr	12.63	0.03
V	0.071	0.002
Mo	0.052	0.003

Information Mass Fraction Values: Information mass fraction values are listed in Table 2. The information value for each analyte is an estimate obtained reported by one of the collaborating laboratories.

Table 2. Information Mass Fraction Values for SRM 133b Chromium-Molybdenum Steel

Constituent	Mass Fraction (%)
N	0.05
Mg	<0.0005
Al	<0.005
Ca	<0.0005
Sn	0.004
Pb	<0.0005

[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.

Table 3. Analytical Methods Used for SRM 133b Chromium-Molybdenum Steel

Element	Methods[(a)]
C	1
Mn	2, 3
P	4, 5
S	1
Si	6, 7
Cu	3, 8, 9
Ni	3, 10, 11
Cr	12, 13
V	3, 14, 15
Mo	3

[(a)]Key to Methods in Table 3:

1. Combustion-Infrared
2. Peroxydisulfate arsenite (some labs removed Cr by precipitation with ZnO)
3. Atomic Absorption
4. Molybdenum blue photometric
5. Ammonium phosphovanadate photometric
6. Perchloric acid dehydration
7. Silicomolybdate photometric
8. Diethyldithiocarbamate photometric
9. Neocuproine photometric
10. Dimethylglyoxime precipitate titrated with cyanide
11. Weighed as nickel dimethylglyoxime
12. Peroxydisulfate oxidation-$FeSO_4$-$KMnO_4$ titration
13. Peroxydisulfate oxidation - potentiometric titration with ferrous ammonium sulfate
14. N-phenylbenzohydroxamic acid photometric
15. Nitric acid oxidation – potentiometric titration with ferrous ammonium sulfate

REFERENCES

[1] Thompson, A.; Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (2008); available at http://www.nist.gov/pml/pubs/index.cfm (accessed Sep 2014).

[2] Hahn, G.J. and Meeker, W.Q.; *Statistical Intervals: A Guide for Practitioners*, John Wiley & Sons, Inc., New York (1991).

Certificate Revision History: 22 September 2014 (Extension of certification period; editorial changes); 08 March 2004 (Extension of certification period; editorial changes); 12 August 1981 (Original certificate date).

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