NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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Standard Reference Material® 1270a
Chromium-Molybdenum Low Alloy Steel, A336 (F-22)

(disk form)

CERTIFICATE OF ANALYSIS

Purpose: The certified values delivered by this Standard Reference Material (SRM) are intended primarily for use in validation of chemical and instrumental methods of analysis for elemental content of iron and steel alloys. The certified values can also be used to validate value assignment of a laboratory's in-house reference materials.

Description: A unit of SRM 1270a consists of one disk approximately 32 mm in diameter and 19 mm thick.

Certified Values: A NIST certified value is the present best estimate of the true value [1]. The certified values for SRM 1270a are shown in the table below and are metrologically traceable to the International System of Units (SI) derived unit of mass fraction, expressed as percent.

Certified Values for Elements in SRM 1270a

Element	Mass Fraction[(a)] (%)	Element	Mass Fraction[(a)] (%)
Arsenic (As)	0.017 2 ± 0.001 9	Nickel (Ni)	0.177 2 ± 0.005 6
Boron (B)	0.004 48 ± 0.000 12	Phosphorus (P)	0.004 01 ± 0.000 37
Carbon (C)	0.079 4 ± 0.004 6	Silicon (Si)	0.237 ± 0.016
Chromium (Cr)	2.317 ± 0.014	Sulfur (S)	0.006 35 ± 0.000 94
Cobalt (Co)	0.039 9 ± 0.004 7	Tin (Sn)	0.016 09 ± 0.000 94
Copper (Cu)	0.116 8 ± 0.002 5	Titanium (Ti)	0.001 58 ± 0.000 30
Lead (Pb)	0.002 04 ± 0.000 18	Vanadium (V)	0.012 98 ± 0.000 81
Manganese (Mn)	0.636 ± 0.015	Zirconium (Zr)	0.006 4 ± 0.002 3
Molybdenum (Mo)	0.942 2 ± 0.008 6		

[(a)] Values are expressed as $x \pm U_{95\%}(x)$, where x is the certified value and $U_{95\%}(x)$ is the expanded uncertainty of the certified value [2–5]. The true value of the analyte lies within the interval $x \pm U_{95\%}(x)$ with 95 % confidence. For guidance in propagating this uncertainty, see reference 4.

Non-Certified Values: Non-certified values based on single measurement methods are provided in Appendix A.

Period of Validity: The certified values delivered by **SRM 1270a** are valid indefinitely within the measurement uncertainty specified. The certified values are nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Certified Values: NIST will monitor this SRM over the period of its validity. If substantive technical changes occur that affect the certification, NIST will issue an amended certificate through the NIST SRM website (https://www.nist.gov/srm) and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

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Storage: Store the SRM in its original container in a dry location (relative humidity <50 %) at room temperature (20 °C to 25 °C).

Use: The test surface is the side opposite to the labeled surface, which includes the SRM number. The certified values are valid for the entire thickness of the unit. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. For direct measurement techniques, the minimum recommended measurement area is a total of 13 mm^2 covered by one or more independent measurements. The minimum recommended sample mass is about 250 mg based on an estimate of the mass probed by XRF over the range of analytes. Each packaged disk has been prepared by finishing the test surface using a milling machine. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface. It was found by NIST that abrasive paper must be changed frequently during surface grinding. Used paper loses its ability to remove contaminants from the surface of the steel.

Source and Preparation: The material for SRM 1270a was obtained from a commercial manufacturer of low alloy steel. See reference 6 for further details. The material was cleaned, sliced, labeled and packaged at NIST.

Analysis: Homogeneity testing of the material for SRM 1270a was performed at NIST. Measurements used to certify SRM 1270a were performed at NIST and collaborating laboratories using a variety of instrumental and wet chemical methods [7]. This material was tested using both the solid disks and chips prepared from the disks.

Notice to Users: NIST strives to maintain the SRM inventory supply, but NIST cannot guarantee the continued or continuous supply of any specific SRM. Accordingly, NIST encourages the use of this SRM as a primary benchmark for the quality and accuracy of the user's in-house reference materials and working standards. As such, the SRM should be used to validate the more routinely used reference materials in a laboratory. Comparisons between the SRM and in-house reference materials or working measurement standards should take place at intervals appropriate to the conservation of the SRM and the stability of relevant in-house materials. For further guidance on how this approach can be implemented, contact NIST by email at srms@nist.gov.

REFERENCES

[1] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Molloy, J.; Nelson, M.A.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sander, L.C.; Schiel, J.E.; Sharpless, K.E.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Material Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2021 edition; National Institute of Standards and Technology, Gaithersburg, MD (2021); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2021.pdf (accessed Aug 2024).

[2] Efron, B.; Tibshirani, R.J.; *An Introduction to the Bootstrap*; Chapman & Hall: London, UK (1993).

[3] Searle, S.R.; Casella, G.; McCulloch, C.E.; *Variance Components*; John Wiley: Hoboken, NJ (1992).

[4] Possolo, A.M.; *Evaluating, Expressing, and Propagating Measurement Uncertainty for NIST Reference Materials*; NIST SP 260-202; National Institute of Standards and Technology, Gaithersburg, MD (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-202.pdf (accessed Aug 2024).

[5] JCGM 100:2008; *Evaluation of Measurement Data — Guide to the Expression of Uncertainty in Measurement* (GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (2008); available at https://www.bipm.org/en/committees/jc/jcgm/publications (accessed Aug 2024); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; National Institute of Standards and Technology, Gaithersburg, MD (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Aug 2024).

[6] Scruggs, B.; Sieber, J.R.; Paul, R.; Chen-Mayer, H.; Marlow, A.F.; Yen, J.H.; *Certification of Standard Reference Material® 1270a: Cr-Mo Low Alloy Steel A336 (F-22) (disk form)*. NIST Special Publication (NIST SP) 260-231; National Institute of Standards and Technology, Gaithersburg, MD (2022); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-231.pdf (accessed Aug 2024).

If you use this SRM in published work, please reference:

Scruggs B, Sieber JR, Paul R, Chen-Mayer H, Marlow AF, Yen JH (2022) Certification of Standard Reference Material® 1270a: Cr-Mo Low Alloy Steel A336 (F-22) (disk form). (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) NIST SP 260-231. https://doi.org/10.6028/NIST.SP.260-231

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Certain commercial equipment, instruments, or materials may be identified in this Certificate of Analysis 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.

Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, MD 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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APPENDIX A

Non-Certified Value: Non-certified values are best estimates based on currently available information. However, they do not meet NIST's criteria for certification [1] and are provided with associated uncertainties that may not include all sources of uncertainty [5]. Non-certified values cannot be used to establish metrological traceability to the SI or another higher-order reference system. They may be used to establish traceability of test results to these values for this reference material. Non-certified values could be used in situations where metrological traceability to the SI is not necessary, for example method harmonization, method development or quality control.

Non-Certified Values for Elements in SRM 1270a

Constituent	Mass Fraction (mg/kg)	Expanded Uncertainty (mg/kg)	Coverage Factor, k
Nitrogen (N)[(a)]	98.5	2.3	2.20

[(a)] The value for nitrogen is the mean of results obtained by a collaborating laboratory. The expanded uncertainty is calculated as $U = ku_c$ where u_c is the combined uncertainty at the level of one standard deviation, and the coverage factor, $k = 2.20$, was determined from the Student's t -distribution corresponding to the associated degrees of freedom and 95 % confidence level [2].

Period of Validity: The non-certified value delivered by **SRM 1270a** is valid indefinitely within the measurement uncertainty specified. The value assignment is nullified if the material is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Non-Certified Value: NIST will monitor this material to the end of its period of validity. If substantive technical changes occur that affect the non-certified value during this period, NIST will update this Certificate of Analysis and notify registered users. SRM users can register online from a link available on the NIST SRM website or fill out the user registration form that is supplied with the SRM. Registration will facilitate notification. Before making use of any of the values delivered by this material, users should verify they have the most recent version of this documentation, available through the NIST SRM website (https://www.nist.gov/srm).

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