National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 882

Nickel-Copper Alloy (65Ni-31Cu-3Al)
(granule form)

This Standard Reference Material (SRM) is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of nickel and nickel-copper alloys and materials of similar matrix. It can be used to validate value assignment of in-house reference materials. A unit of SRM 882 consists of one bottle containing approximately 100 g of granules.

Certified Mass Fraction Values: Certified values for constituents of SRM 882 are reported in Table 1 as mass fractions of the elements in a nickel-copper alloy matrix [1]. A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been taken into account [2]. A certified value is the present best estimate of the true value. The certified values are metrologically traceable to the SI derived unit for mass fraction (expressed as percent). The expanded uncertainty estimates are expressed at a confidence level of approximately 95 %.

Table 1. Certified Mass Fraction Values for SRM 882 Nickel-Copper Alloy

Constituent	Mass Fraction (%)	Expanded Uncertainty (%)
Aluminum (Al)	2.845	0.054
Carbon (C)	0.0065	0.0016
Copper (Cu)	31.035	0.075
Iron (Fe)	0.0093	0.0015
Nickel (Ni)	65.25	0.11
Titanium (Ti)	0.565	0.012

Expiration of Certification: The certification of **SRM 882** is valid indefinitely within the measurement uncertainty specified, provided the SRM is handled and stored in accordance with instructions given in this certificate (see "Instructions for Handling, Storage, and Use"). Periodic 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 before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of technical measurements was performed by J.I. Schultz, formerly of NIST. Review and revision of values and uncertainty estimates were coordinated by J.R. Sieber of the NIST Chemical Sciences Division.

Statistical consultation for this SRM was provided by A. Possolo 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 Issue Date: 20 April 2020
Certificate Revision History on Last Page

Steven J. Choquette, Director
Office of Reference Materials

INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

The nickel-copper alloy granules may be analyzed in the as-received form. To relate analytical determinations to the certified values in this Certificate of Analysis, a minimum test portion of 500 mg should be used. Before sampling, it is recommended to mix the granules by inverting and rotating the bottle by hand for at least one minute. A bottle containing unused material should be recapped immediately and stored at room temperature away from light.

To use the uncertainty estimates given in this certificate, divide the expanded uncertainty by $k = 2$ to obtain the combined standard uncertainty. The effective degrees of freedom of the combined standard uncertainty are ≥ 60.

PREPARATION AND ANALYSIS[(1)]

The material for SRM 882 was prepared by water atomization at the International Nickel Co., Inc. (Sterling Forest, NY). At NIST, the material was sieved to remove very coarse and very fine particles, thoroughly blended and bottled.

Each certified value is an unweighted mean of the results from the methods listed in Table 2. The uncertainty listed with each certified value is an expanded uncertainty about the mean, with coverage factor, $k = 2$, calculated following the ISO/JCGM Guide [3-4]. Detailed descriptions of many of the methods of analysis may be found in Part 12, Chemical Analysis of Metals and Metal Bearing Ores, Annual Book of ASTM Standards for 1979 [5].

Analyses leading to the value assignments of this SRM were performed at NIST by E.R. Deardorff, B.I. Diamondstone, T.C. Rains, M.B. Blackburn, Y. Dokiya, and R.K. Bell, all formerly of the NIST Chemical Sciences Division. Analytical determinations were also performed by S.W. Drigot, GE Automatic Electric Laboratories, Inc. (Northlake, IL); M.M. Yanak, International Nickel Co., Inc. (Sterling Forest, NY); and S. Kallmann, Ledoux & Company (Teaneck, NJ).

Table 2. Test Methods Employed in the Value Assignments of SRM 882 Nickel-Copper Alloy

Element	Test Methods Used at NIST and Collaborating Laboratories
Aluminum	Flame atomic absorption spectrometry (FAAS); Electrodeposition of Cu and Ni – NH_4OH-cupferron-NH_4OH-8-quinolinol spectrophotometric; Hg cathode separation-cupferron-Al_2O_3 gravimetric
Carbon	Combustion with infrared detection; Combustion with chromatographic detection
Copper	Electrodeposition gravimetry
Iron	FAAS; Spectrochemical
Manganese	Spark source mass spectrometry (SSMS); Atomic absorption spectrometry (AAS)
Nickel	Gravimetric
Silicon	SSMS; AAS
Sulfur	Combustion with iodometric titration; Combustion with infrared detection
Titanium	Hg cathode separation-chromotropic acid spectrophotometric; H_2O_2 photometric; Hg cathode separation-cupferron-H_2O_2 spectrophotometric; Hg cathode separation-diantipyrylmethane-H_2O_2 spectrophotometric

(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.

ADDITIONAL CONSTITUENTS

Noncertified values are provided for the following additional constituents in SRM 882. These values are not certified, because NIST cannot vouch fully for the calibrations of the test methods and other details.

Reference Mass Fraction Values: Reference values for two constituents of SRM 882 are reported in Table 3 as mass fractions of the total elements in a nickel-copper matrix. A NIST Reference Value is a non-certified value that is the present best estimate based on available data; however, the value does not meet the NIST criteria for certification and is provided with an associated uncertainty that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient statistical agreement among multiple analytical methods [2]. The mass fraction reference values, as determined by the methods used, are expressed as percent. Each reference value is an unweighted mean of results obtained using the test methods in Table 2. The expanded uncertainty, U, is an expanded uncertainty about the mean, with coverage factor, $k = 2$ [3-4]. Results derived from the use of these values are considered by NIST to be traceable only to the values themselves.

Table 3. Reference Mass Fraction Values for SRM 882 Nickel-Copper Alloy

Constituent	Mass Fraction (%)	Expanded Uncertainty (%)
Silicon (Si)	0.006	0.002
Sulfur (S)	0.0014	0.0007

Information Mass Fraction Values: Information values for constituents in SRM 882 are reported as mass fractions in Table 4. A NIST Information Value is a value that may be of interest to the SRM user, but insufficient information is available to assess the uncertainty associated with the value [2]. Information values cannot be used to establish metrological traceability.

Table 4. Information Mass Fraction Values for SRM 882 Nickel-Copper Alloy

Constituent	Mass Fraction (%)
Arsenic (As)	0.0001
Boron (B)	0.0001
Chromium (Cr)	0.0001
Cobalt (Co)	0.007
Lead (Pb)	0.0006
Magnesium (Mg)	0.001
Manganese (Mn)	0.0007
Selenium (Se)	0.0002
Silver (Ag)	0.0004
Tin (Sn)	0.003
Vanadium (V)	0.0001
Zinc (Zn)	0.0005

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] 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 https://www.nist.gov/pml/special-publication-811 (accessed Apr 2020).

[2] May, W.; Parris, R.; Beck, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136: U.S. Government Printing Office: Washington, DC (2000); available at https://www.nist.gov/system/files/documents/srm/SP260-136.PDF (accessed Apr 2020).

[3] Sieber, J.R., Possolo, A.M., Epstein, M.S., *A Retuned Horwitz Procedure for Upgrading Certificates of Older Standard Reference Materials*; NIST Special Publication 260-198; available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-198.pdf (accessed Apr 2020).

[4] 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 (JCGM) (2008); available at https://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf (accessed Apr 2020); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297, U.S. Government Printing Office: Washington, DC (1994); available at https://www.nist.gov/pml/nist-technical-note-1297 (accessed Apr 2020).

[5] ASTM, *Part 12, Chemical Analysis of Metals and Metal Bearing Ores*; Annu. Book ASTM Stand., (1979).

Certificate Revision History: 20 April 2020 (Revised values and uncertainties for Al, C, Cu. Fe and Ti; revised uncertainty for Ni; reassignment of values for Si and S as reference values; reassignment of Mn value as an information value; title update; editorial changes); 03 August 1979 (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: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at https://www.nist.gov/srm.