National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1775

Refractory Alloy MP-35-N

(In cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of a disk, approximately 35 mm (1.375 in) in diameter and 12.7 mm (0.5 in) thick intended for use with optical emission and X-ray spectrometric methods of analysis.

Certified Mass Fraction Values: Certified mass fraction values are provided in Table 1 [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 investigated or taken into account [2]. A certified value is the present best estimate of the true value based on the results of analyses performed at NIST and collaborating laboratories.

Reference Mass Fraction Values: Reference mass fraction values are provided in Table 2 [1]. Reference values are non-certified values that are the present best estimates of the true values; however, the values do not meet the NIST criteria for certification and are provided with associated uncertainties that may reflect only measurement precision, may not include all sources of uncertainty, or may reflect a lack of sufficient agreement among multiple analytical methods [2].

Information Values: Information values are provided in Table 3 for niobium, nitrogen, silicon, and tungsten. No uncertainties are reported for these values as there is insufficient information with which to make the appropriate statistical assessments.

Expiration of Certification: The certification of **SRM 1775** is valid indefinitely, within the measurement uncertainty 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 material 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 work leading to the certification of this SRM was provided by J.D. Fassett of the NIST Chemical Sciences Division.

Analytical measurements were performed by C.M. Beck II, W.R. Kelly, R.M. Lindstrom, J.L. Mann, R.L. Paul, M.L. Salit, J.R. Sieber, and R.D. Vocke, Jr. of the NIST Chemical Sciences Division.

Statistical analysis of the homogeneity and certification data was provided by H-k. Liu 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: 09 July 2014
Certificate Revision History on Last Page

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

INSTRUCTIONS FOR USE

The unlabeled surface of the disk is intended for measurement. The entire area of the surface is certified and measurements may be made at any point on the surface. The material is considered to be homogeneous throughout the entire thickness of the disk. Each packaged disk has been prepared by finishing the unstamped surface with 120 grit zirconium oxide abrasive paper. The user is urged to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface of the disk.

PREPARATION AND ANALYSIS[(1)]

UNS R30035 Refractory Alloy MP-35-N (Cr20-Ni35-Mo9, Co balance) was cast, under contract, by Carpenter Technology Corporation, Port Washington, PA. In accordance with NIST specifications, the four cast billet lengths supplied were all the same heat with minimum compositional differences. D.K. Associates, Buffalo, NY forged, under contract, two of the billet lengths into four rods, 3.5 cm in diameter and ~335 cm in length (1.375 in × ~11 ft). The forged rods were cut into disks by NIST and designated SRM 1775. The two remaining billet lengths were chipped by NIST and designated SRM 2175. Table 4 summarizes the analytical chemical methods applied at NIST for the characterization of the composition of this SRM.

Certified Mass Fraction Values: The certified values for cobalt, chromium, nickel, molybdenum, and sulfur were determined by primary methods at NIST with confirmation from either a second NIST method or data from the cooperating laboratories. The certified values for manganese, vanadium, titanium, boron, and iron are certified on the basis of one method at NIST in combination with data from the outside participating laboratories. The uncertainties in the certified values are reported as ku_c, where k is the coverage factor for a 95 % confidence level and u_c is the "combined standard uncertainty" calculated according to the ISO/JCGM Guide [3]. The value of u_c is intended to represent, at the level of one standard deviation, the combined effect of all the uncertainties in the certified values. For elements certified by multiple independent analytical methods, the procedure of Schiller and Eberhardt was used to combine the data [4]. The measurand is the total mass fraction for each analyte listed in Table 1. The certified values are metrological traceable to the SI unit of mass.

Table 1. Certified Mass Fraction Values for SRM 1775

Constituent	Mass Fraction (%)
Chromium (Cr)	20.472 ± 0.035
Cobalt (Co)	33.352 ± 0.027
Iron (Fe)	0.91 ± 0.10
Molybdenum (Mo)	9.508 ± 0.012
Nickel (Ni)	34.911 ± 0.029
Titanium (Ti)	0.730 ± 0.032
	Mass Fraction (mg/kg)
Boron (B)	97 ± 24
Manganese (Mn)	121 ± 15
Sulfur (S)	13 ± 1
Vanadium (V)	95 ± 14

[(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.

Reference Mass Fraction Values: The reference values for aluminum, carbon, and copper are derived from data provided by the cooperating laboratories. The reference value for phosphorus is derived from NIST radiochemical neutron activation analysis (RNAA). Uncertainties are calculated in the same manner as for certified values. The measurand is the mass fraction for each analyte listed in Table 2 as determined by the methods listed in Table 4. The reference values are metrological traceable to the SI unit of mass.

Table 2. Reference Mass Fraction Values for SRM 1775

Constituent	Mass Fraction (%)
Aluminum (Al)	0.024 ± 0.003
	Mass Fraction (mg/kg)
Carbon (C)	51 ± 11
Copper (Cu)	46 ± 4
Phosphorus (P)	6 ± 1

Information Mass Fraction Values: The information value for each analyte is an estimate obtained from one or more NIST or collaborator test methods. No uncertainty is provided because there is insufficient information available for its assessment. Information values cannot be used to establish metrological traceability.

Table 3. Information Values for SRM 1775

Constituent	Mass Fraction (%)
Niobium (Nb)	0.03
Nitrogen (N)	0.002
Silicon (Si)	0.02
Tungsten (W)	0.02

Table 4. NIST Analytical Methods

Methods Used	Elements Determined
Inductively coupled plasma optical emission spectrometry (ICP-OES)	Cr, Co, Mo, Ni
Isotope dilution thermal ionization mass spectrometry (ID-TIMS)	S
Instrumental neutron activation analysis (INAA)	Cr, Mn, Ni
Prompt gamma activation analysis(PGAA)	B
Radiochemical neutron activation analysis (RNAA)	P
X-ray fluorescence spectrometry (XRF)	Cr, Co, Fe, Mo, Ni, Nb, Ti, W, V

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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/sp811/index.cfm (accessed Jul 2014).

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[4] Schiller, S.B.; Eberhardt, KR., *Combining Data from Independent Chemical Analysis Methods*; Spectrochimica Acta, Vol. 46B, pp. 1607–1613, (1991).

Certificate Revision History: 09 July 2014 (Updated certification date to indefinite; editorial changes); 29 November 2000 (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, email srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.