National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1240c

Aluminum Alloy 3004
(disk form)

This Standard Reference Material (SRM) is intended primarily for use in evaluating instrumental methods of analysis including glow discharge optical emission spectrometry, spark source optical emission spectrometry, and X-ray fluorescence spectrometry. A unit of SRM 1240c consists of a disk approximately 6.3 cm in diameter and 1.9 cm thick.

The certified values for selected elements in SRM 1240c are listed in Table 1. The user should note that there are two certified values given for Titanium (Ti). Each unit of SRM 1240c carries a serial number. The correct value for Ti is the value associated with the serial number of the unit. Reference values for selected elements are listed in Table 2. Information values are listed in Table 3. For all elements, values are reported as mass fractions [1]. Value assignment categories are based on the definition of terms and modes used at NIST for chemical reference materials [2] and uncertainties are assessed according to the ISO/JCGM Guide [3].

Certified Values: 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. A 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 4. The uncertainty listed with the value is an expanded uncertainty based on a 95 % confidence interval [4] and is calculated according to the method in the ISO/JCGM Guide [3].

Reference Values: 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 not include all sources of uncertainty. The uncertainty listed with the value is an expanded uncertainty based on a 95 % confidence interval [4] and is calculated according to the method in the ISO/JCGM Guide [3].

Information Values: 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.

Expiration of Certification: The certification of **SRM 1240c** 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 Use"). Accordingly, periodic recertification of this SRM is not required. The certification will be 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 of this certificate. NIST will notify the purchaser. Registration (see attached sheet or register online) will facilitate notification.

Coordination of the technical measurements for certification was accomplished under the direction of J.R. Sieber of the NIST Chemical Sciences Division.

Analytical measurements for certification of this SRM were performed by M.R. Winchester of the NIST Chemical Sciences Division.

Carlos A. Gonzalez, Chief
Chemical Sciences Division

Gaithersburg, MD 20899
Certificate Issue Date: 20 February 2019
Certificate Revision History on Last Page

Steven J. Choquette, Director
Office of Reference Materials

Statistical consultation for this SRM was provided by D.D. Leber and S.D. Leigh of the NIST Statistical Engineering Division.

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

Material Preparation: The material for SRM 1240c was obtained in the form of four castings prepared by the Aluminum Company of America[1]. Titanium was added for grain refinement of the alloy. The method of addition may cause the Ti content to change from one casting to the next. The castings were cut and packaged at NIST under the supervision of D.F. Friend of the NIST Material Measurement Laboratory and M.P. Cronise of the NIST Office of Reference Materials.

INSTRUCTIONS FOR USE

The test surface is the side opposite to the labeled surface, which includes the SRM number and a serial number. The entire thickness of the unit is certified. 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. For example, preparation for glow discharge optical emission measurements at NIST involved grinding the surface with abrasive paper. The user is cautioned to use care when either resurfacing the disk or performing additional polishing as these processes may contaminate the surface. The material should be stored in its original container in a cool, dry location.

This material was tested using both the solid disks and chips prepared from the disks. The certified values are considered to be representative of the overall average composition of the material. The casting method results in material that is relatively uniform in composition regardless of the distance from the center of the piece. Measurements using a small X-ray beam (approx. 3 mm x 4 mm ellipse) showed localized areas of high X-ray count rate for Ti, V, Cr, Fe, Cu, Zn, and Ga. Therefore, regardless of the method employed, it is recommended to follow accepted standard methods of test for Al alloys, which may specify the manner in which measurement locations are chosen and the number of locations to be measured.

The casting method used to prepare this material may result in different amounts of grain refiner in each casting. The user is cautioned to note the serial number of the disk, and use the appropriate certified value for Ti from Table 1 and footnotes a and b.

Table 1. Certified Values for SRM 1240c Aluminum Alloy 3004[a]

Elements	Mass Fraction (%)	Expanded Uncertainty (%)	Coverage Factor, *k*
Silicon (Si)	0.1804	0.0038	2.3
Iron (Fe)	0.501	0.016	2.0
Copper (Cu)	0.1484	0.0054	2.0
Manganese (Mn)	1.268	0.014	2.0
Magnesium (Mg)	1.110	0.021	2.0
Nickel (Ni)	0.00434	0.00080	2.0
Zinc (Zn)	0.0514	0.0011	2.0
Titanium (Ti)[b]	0.0218	0.0015	2.0
Ti[c]	0.0204	0.0015	2.0
Vanadium (V)	0.01850	0.00057	2.0
Gallium (Ga)	0.0181	0.0015	2.0

[a] The measurands are the mass fractions of the elements. The certified values are metrologically traceable to the SI unit of mass, expressed as a percent.
[b] This Ti value and its associated uncertainty estimate must be used with units having serial numbers 1 through 91, inclusive.
[c] This Ti value and its associated uncertainty estimate must be used with units having serial numbers 92 through 181, inclusive.

[1]Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately 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 2. Reference Values for SRM 1240c Aluminum Alloy 3004[a]

Elements	Mass Fraction (mg/kg)	Expanded Uncertainty (mg/kg)	Coverage Factor, *k*
Beryllium (Be)	0.11	0.03	2.0
Cadmium (Cd)	6.5	0.1	2.4
Chromium (Cr)	5.4	0.6	2.0
Tin (Sn)	4	1	2.0
Zirconium (Zr)	23	3	2.1

[a] The measurand is the mass fraction of the elements listed, as determined by the analytical methods indicated in Table 4. The reference values are metrologically traceable to the SI unit of mass.

Table 3. Information Values for SRM 1240c Aluminum Alloy 3004

Elements	Mass Fraction (mg/kg)
Strontium (Sr)	<1
Lead (Pb)	9

Table 4. Analytical Methods

Element	Methods[a]
Si	GD-OES, ICP-OES
Fe	GD-OES, ICP-OES
Cu	GD-OES, ICP-OES
Mn	GD-OES, ICP-OES, Colorimetry
Mg	GD-OES, ICP-OES, FAAS
Ni	GD-OES, ICP-OES
Zn	GD-OES, ICP-OES
Ti	GD-OES, ICP-OES
V	GD-OES, ICP-OES
Ga	GD-OES, ICP-OES
Be	SS-OES
Cr	SS-OES
Cd	SS-OES
Sn	SS-OES
Pb	SS-OES
Zr	GD-OES, ICP-OES
Sr	GD-OES

[a]Key: GD-OES = Glow Discharge-Optical Emission Spectrometry at NIST
ICP-OES = Inductively-Coupled Plasma-Optical Emission Spectrometry
Colorimetry = Oxidation by KIO_4 followed by absorbance measurements at 545 nm.
FAAS = Flame Atomic Absorption Spectrophotometry
SS-OES = Spark Source-Optical Emission Spectrometry

Cooperating Laboratories: Analytical determinations for certification of this SRM were performed by the following laboratories:

Alcan International Limited, Arvida Research and Development Centre, Jonquière, Québec, Canada. Coordinated by H. Hamouche. Alcan also provided homogeneity testing using spark source optical emission spectrometry.

Aluminum Company of America, Alcoa Technical Center, Alcoa Center, Pennsylvania, USA. Coordinated by M. Ruschak.

REFERENCES

[1] 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 Feb 2019).

[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.; *Definitions 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/sites/default/files/documents/srm/SP260-136.PDF (accessed Feb 2019).

[3] 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 Feb 2019); 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 Feb 2019).

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

Certificate Revision History: 20 February 2019 (Title updated; editorial changes); **09 September 2014** (Extension of certification period; editorial changes); **09 October 2003** (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 https://www.nist.gov/srm.