National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1240c

Aluminum Alloy 3004

(In cooperation with ASTM International)

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. Aluminum Alloy 3004 is also available in chip form as SRM 853a.

The certified values for 10 elements in SRM 1240c are listed in Table 1. The user should note that there are two certified values given for 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 five elements are listed in Table 2. Information values for two elements 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 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 accounted for by NIST. 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 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 Guide [3].

Information Values: Information values are non-certified values with no uncertainty reported because there is insufficient information with which to make the appropriate assessments.

Expiration of Certification: The certification of this SRM is valid until **01 August 2028**, within the uncertainty specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. See "Instructions for Use". However, the certification will be nullified if the SRM is damaged or contaminated.

Stability: This material is considered to be stable during the period of certification. NIST will monitor this material and will report any significant changes in certification to the purchaser. Return of the attached registration card will facilitate notification.

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

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

Willie E. May, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 09 October 2003

John Rumble, Jr., Chief
Measurement Services Division

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

The support aspects involved in the certification and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by P. Fagan of the NIST Measurement Services Division.

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 and M.P. Cronise of the NIST Measurement Services Division.

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

Constituent	Value (mass fraction %)	Expanded Uncertainty (mass fraction %)	Expansion Factor, *k*
Si	0.1804	0.0038	2.3
Fe	0.501	0.016	2.0
Cu	0.1484	0.0054	2.0
Mn	1.268	0.014	2.0
Mg	1.110	0.021	2.0
Ni	0.00434	0.00080	2.0
Zn	0.0514	0.0011	2.0
Ti[a]	0.0218	0.0015	2.0
Ti[b]	0.0204	0.0015	2.0
V	0.01850	0.00057	2.0
Ga	0.0181	0.0015	2.0

[a] This Ti value and its associated uncertainty estimate must be used with units having serial numbers 1 through 91, inclusive.
[b] 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

Constituent	Value (mass fraction, $^{mg}/_{kg}$)	Expanded Uncertainty (mass fraction, $^{mg}/_{kg}$)	Expansion Factor, k
Be	0.11	0.03	2.0
Cd	6.5	0.1	2.4
Cr	5.4	0.6	2.0
Sn	4	1	2.0
Zr	23	3	2.1

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

Constituent	Value (mass fraction $^{mg}/_{kg}$)
Sr	<1
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., *Guide for the Use of the International System of Units (SI)*, NIST Special Publication 811, 1995 Ed. (1995).

[2] May, W.E.; Parris, R.M.; Beck II, C.M.; Fassett, J.D.; Greenberg, R.R.; Guenther, F.R.; Kramer, G.W.; Wise, S.A.; Gills, T.E.; Colbert, J.C.; Gettings, R.J.; MacDonald, B.S., *Definitions of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements,* NIST Spec. Pub. 260-136, U.S. Government Printing Office: Washington, DC, p. 16 (2000).

[3] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed., ISO, Geneva, Switzerland (1993); 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 http://physics.nist.gov/Pubs/.

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

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-475, email srminfo@nist.gov, or via the Internet http://www.nist.gov/srm.