National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 1255b

Aluminum Alloy 356
(disk form)

This Standard Reference Material (SRM) is an aluminum alloy intended primarily for evaluation of methods for analysis of elements in aluminum alloys. It can be used to validate value assignment of in-house reference materials. A unit of SRM 1255b consists of a disk approximately 6.3 cm in diameter and 1.9 cm thick.

Certified Mass Fraction Values: Certified value for constituents in SRM 1255b are listed in Table 1 as mass fractions of the total amounts of the elements in an aluminum 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. A certified value is the present best estimate of the true value. The certified values are metrologically traceable to the SI derived unit of mass fraction expressed as percent. Each assigned value is an unweighted mean of the results from three analytical methods across multiple laboratories. The uncertainty listed with the value is an expanded uncertainty, expressed at a coverage level of approximately 95 %, using the coverage factors listed [3-5].

Expiration of Certification: The certification of **SRM 1255b** is valid indefinitely, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Instructions for Storage, Handling and Use"). Reference values are expected also to remain valid indefinitely. 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 before the expiration 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 of this SRM was performed by J.R. Sieber of the NIST Chemical Sciences Division.

Measurements for value assignment of SRM 1255b were performed by J.R. Sieber and M.R. Winchester of the NIST Chemical Sciences Division. Additional analyses were performed by collaborating laboratories, including H. Hamouche of Alcan International Limited, Arvida Research and Development Centre (Jonquière, Québec, Canada) and M. Ruschak of Aluminum Company of America, Alcoa Technical Center (Alcoa Center, PA).

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

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

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Certificate Revision History on Last Page

Steven J. Choquette, Director
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Table 1. Certified Mass Fraction Values for SRM 1255b

Constituent	Value (%)	Expanded Uncertainty (%)	Coverage Factor *k*
Si	7.298	0.050	2.0
Fe	0.1170	0.0068	2.1
Cu	0.1161	0.0018	2.0
Mn	0.0527	0.0008	2.1
Mg	0.3822	0.0051	2.0
Ni	0.0179	0.0013	2.0
Zn	0.0842	0.0014	2.0
Ti[(a)]	0.1477	0.0048	2.0
Ti[(b)]	0.1535	0.0046	2.0
V[(a)]	0.0316	0.0024	2.0
V[(b)]	0.0324	0.0025	2.0
Sr[(a)]	0.0164	0.0016	2.0
Sr[(b)]	0.0140	0.0012	2.0
Ga	0.0175	0.0021	2.0
Sn	0.1334	0.0037	2.0
Pb	0.0182	0.0006	2.0

[(a)] These values and associated uncertainty estimates for Ti, V and Sr must be used with units having serial numbers 1000 through 1094, inclusive.
[(b)] These values and associated uncertainty estimates for Ti, V and Sr must be used with units having serial numbers 1095 through 1186, inclusive.

INSTRUCTIONS FOR STORAGE, HANDLING AND USE

The user should note that there are two certified values given for Ti, two for V, and two for Sr. Each unit of SRM 1255b carries a serial number. The correct values for Ti, V, and Sr are the values associated with the serial number of the unit as marked with footnotes in Table 1.

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. 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 representative of the overall average composition of the material. The casting method results in material that is uniform in composition regardless of the distance from the center of the piece. Measurements using a small X-ray beam (approximately 3 mm × 4 mm ellipse) showed localized areas of high X-ray count rate for Ti, V, Mn, 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 procedure by which measurement locations are chosen and the number of locations to be measured.

PREPARATION AND ANALYSIS[(1)]

The material for SRM 1255b was obtained in the form of four castings prepared by the Aluminum Company of America. Titanium was added for grain refinement of the alloy. The method of addition may cause the Ti, V, and Sr contents to change from one casting to the next. The castings were sliced and packaged at NIST. Homogeneity testing was performed by Alcan International Limited using spark source optical emission spectrometry and by NIST using

[1] Certain commercial equipment, instruments, or materials are identified in this certificate 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.

micro X-ray fluorescence spectrometry (XRF). Test methods from which results were used for value assignment are listed in Table 3.

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 values for Ti, V, and Sr from Table 1 and footnotes a and b.

ADDITIONAL CONSTITUENTS: Noncertified values are provided for the following additional constituents in SRM 1255b.

Reference Mass Fraction Value: A reference value for one constituent of SRM 1255b is reported in Table 2 as a mass fraction of the total element in an aluminum matrix. A reference value is a non-certified value that is the present best estimate of the true value based on available data; however, the value does not meet the NIST criteria for certification and is provided with an associated uncertainty that may not include all sources of uncertainty or may reflect a lack of sufficient statistical agreement among multiple analytical methods [2]. The reference value, as determined by the methods used, is metrologically traceable to the derived SI unit of mass fraction expressed as milligrams per kilogram. The assigned value is an unweighted mean of the results from three analytical methods across multiple laboratories. The uncertainty listed with the value is an expanded uncertainty about the mean calculated by combining a between-method variance with a pooled, within-method variance and based on a 95 % coverage interval, with coverage factor *k*, [4,5].

Table 2. Reference Values for SRM 1255b

Constituent	Value (mg/kg)	Expanded Uncertainty (mg/kg)	Coverage Factor *k*
Cr	150	35	4.3

Table 3. Analytical Methods used for SRM 1255b

Element	Methods
Si	GD-OES; ICP-OES; SS-OES
Fe	GD-OES; ICP-OES; SS-OES
Cu	GD-OES; ICP-OES; SS-OES
Mn	GD-OES; ICP-OES; SS-OES
Mg	GD-OES; ICP-OES; SS-OES
Ni	GD-OES; ICP-OES; SS-OES
Zn	GD-OES; ICP-OES; SS-OES
Ti	GD-OES; ICP-OES; SS-OES
V	GD-OES; ICP-OES; SS-OES
Cr	GD-OES; ICP-OES; SS-OES
Ga	GD-OES; ICP-OES; SS-OES
Pb	GD-OES; ICP-OES; SS-OES
Sr	GD-OES; ICP-OES; SS-OES
Sn	GD-OES; ICP-OES; SS-OES

Methods Key:

GD-OES (Glow Discharge Optical Emission Spectrometry at NIST)
ICP-OES (Inductively-Coupled Plasma Optical Emission Spectrometry at Cooperating Laboratories)
SS-OES (Spark Source Optical Emission Spectrometry at Cooperating Laboratories)

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/pubs/index.cfm (accessed Oct 2018).

[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 atNIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136 (2000); available at https://www.nist.gov/srm/upload/SP260-136.pdf (accessed Oct 2018).

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

[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 Oct 2018); 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/pubs/index.cfm (accessed Oct 2018).

[5] Levenson, M.S.; Banks, D.L.; Eberhardt, K.R.; Gill, L.M.; Guthrie, W.F.; Liu, H.K.; Vangel, M.G.;Yen, J.H.; Zhang, N.F.; *An Approach to Combining Results from Multiple Methods Motivated by the ISO GUM*; J. Res. Natl. Inst. Stand. Technol., Vol. 105, pp. 571–579 (2000).

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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: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at https://www.nist.gov/srm.