

Reference Material Certificate

124/05

Aluminium Base (Type of Standard)
Al pure (99.95-99.8% Al), Set 120

Certified Values

Element	Analytical methods used for certification	Mass content ¹⁾ in [%]	Uncertainty ²⁾ in [%]
Silicon (Si)	a, h	0.099	0.006
Iron (Fe)	a, b, c, d, e, f, i	0.143	0.003
Copper (Cu)	a, b, c, d, e, f	0.0538	0.0012
Manganese (Mn)	a, b, c, d, e, f	0.0541	0.0007
Magnesium (Mg)	a, b, c, d, e	0.0537	0.0010
Chromium (Cr)	a, b, c, d, e, f	0.0574	0.0008
Nickel (Ni)	a, b, c, d, e, f	0.0539	0.0012
Zinc (Zn)	a, b, c, d, e, f	0.0536	0.0009
Titanium (Ti)	a, b, c, d, e, i	0.0501	0.0017
Silver (Ag)	b, d	0.0194	0.0009
Arsenic (As)	b, c, d, e	0.0021	0.0002
Boron (B)	b, d	< 0.0002	
Barium (Ba)	a, b, d	0.0133	0.0007
Beryllium (Be)	a, b, c, d, e	0.0019	0.0001
Bismuth (Bi)	a, b, c, e	0.0176	0.0005
Calcium (Ca)	b, c	0.0017	0.0002
Cadmium (Cd)	a, b, c, d, e, f	0.0195	0.0006
Cerium (Ce)	a, b, c, d, e	0.0254	0.0009
Cobalt (Co)	a, b, c, d, e	0.0251	0.0007
Gallium (Ga)	a, b, c, d, e	0.0342	0.0006
Mercury (Hg)	e	< 0.0002	
Lanthanum (La)	a, b, c, d, e	0.0084	0.0003
Lithium (Li)	a, b, c, d, e, f	0.0011	0.0002
Sodium (Na)	b, c, d, f	0.0012	0.0002
Phosphorus (P)	b, c, d, e	0.0010	0.0002
Lead (Pb)	a, b, d, e, f	0.0226	0.0010
Antimony (Sb)	b, c, d, e	0.0236	0.0012
Scandium (Sc)	a, b, c, e	0.0190	0.0003
Tin (Sn)	a, b, c, d, e	0.0200	0.0006
Strontium (Sr)	a, b, c, d, e	0.00016	0.00002
Tantalum (Ta)	e	< 0.0001	
Thallium (Tl)	b, d, e	0.0010	0.0002
Vanadium (V)	a, b, c, e	0.0488	0.0009
Zirconium (Zr)	b, c, e	0.0051	0.0002

- 1) Unweighted mean value of the means of accepted sets of data (consisting of at least 5 but usually 6 single results), each set being obtained by a different digestion and / or method of measurement.
- 2) Uncertainty generated from the 95% confidence interval (calculated as $C(95\%) = t \times S_M / \sqrt{n}$ where t is the appropriate two sided Student's t value at the 95% confidence level for n acceptable mean values and S_M is the single standard deviation of the accepted mean values) in combination with the standard deviation from sample homogeneity measurements using the square root of the summed squares.

Analytical Methods used for Certification:

- a ICP-OES, digestion with caustic soda
- b ICP-OES, digestion with acid
- c ICP-OES, closed vessel digestion with acid
- e ICP-MS, closed vessel digestion with acid
- f FAAS, digestion with acid
- g CV-AAS, closed vessel digestion with acid
- h Spectrophotometry, digestion with caustic soda
- i Spectrophotometry, digestion with acid

Abbreviations:

- ICP-OES: Inductively coupled plasma - optical emission spectrometry
- ICP-MS: Inductively coupled plasma - mass spectrometry
- FAAS: Flame atomic absorption spectrometry
- CV-AAS: Cold vapor atomic absorption spectrometry

Manufacturing

This certified reference material for the analysis of aluminium and its alloys is produced using six strand vertical continuous casting out of a single melt.

Analysis

The analysis of this material was performed in our ISO/IEC 17025 accredited analytical laboratory (STS 0023) by different established wet chemical procedures. Every certified value is the result of multiple independent analyses.

Homogeneity

Homogeneity testing is performed by means of spark emission spectroscopy. Tests involve making multiple measurements on individual samples taken at regular intervals along the entire length of each cast rod. Depending on the mass content of the element, the relative standard deviation of multiple measurements between discs or within one disc is typically found between 0.3% - 1% for alloying and other elements and 0.5% - 5% for trace elements. The homogeneity within one sample is taken into account in the calculation of the uncertainty of the certified value.

Description of Sample

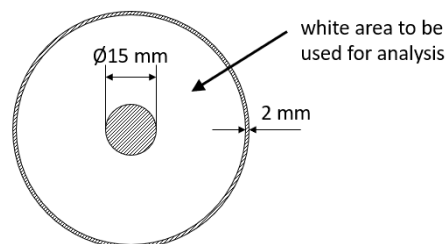
This reference material is available in the form of discs (approx. 65mm diameter and 25mm height)

Intended use and Stability

This certified reference material is primarily intended for use in spark optical emission spectroscopy. Other applications are X-ray fluorescence spectrometry (XRF) and classical wet chemical procedures. The minimum sample size for wet chemical analysis is 0.2g. The material will remain stable for the period given below (certification validity) if it is stored in a dry and clean environment at room temperature.

Instructions for Use

Calibration measurements should be made within a ring (see white area in the picture). For wet chemical analysis chips have to be prepared by turning or milling of the sample surface. For sparac OES analysis, the surface of the material needs to be prepared by milling.



Traceability

Traceability of the certified mass contents to the SI (Système International d'Unités) is ensured by calibration using certified standard solutions or pure metals or substances of known stoichiometry.



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This certificate is valid until: Nov / 2096