

## Reference Material Certificate

# 117/03

Aluminium Base (Type of Standard)

Al 99.99 – 99.95, Set 110

### Certified Values

Element	Analytical Methods used for Certification	Mass content <sup>1)</sup> in [%]	Uncertainty <sup>2)</sup> in [%]
Silicon (Si)	a, f	0.0152	0.0008
Iron (Fe)	a, b, d, f, g	0.0141	0.0004
Copper (Cu)	a, b, c, d, e, g	0.0023	0.0001
Manganese (Mn)	a, b, c, d, e, g	0.0010	0.0001
Magnesium (Mg)	a, b, c, d, g	0.0019	0.0001
Chromium (Cr)	b, c, d, e	0.0013	0.0001
Nickel (Ni)	b, c, d, g	0.0013	0.0001
Zinc (Zn)	b, c, d, e, g	0.0011	0.0001
Titanium (Ti)	a, b, d, e, f	0.0006	0.0001
Silver (Ag)	b, d, e	0.0005	0.0001
Arsenic (As)	e	(< 0.00005)	
Boron (B)	b, d	0.0013	0.0002
Barium (Ba)	a, b, c, d, e	0.00045	0.00004
Beryllium (Be)	a, b, c, d, e	0.00049	0.00003
Bismuth (Bi)	a, b, c, d, e	0.0026	0.0002
Calcium (Ca)	b	(0.0006)	
Cadmium (Cd)	b, c, d, e	0.0003	0.0001
Cerium (Ce)	a, b, c, d, e	0.0003	0.0001
Cobalt (Co)	a, b, c, d, e	0.0014	0.0001
Gallium (Ga)	a, b, c, d, e	0.0014	0.0001
Mercury (Hg)	c, e, h	0.0002	0.0001
Indium (In)	b, c, d, e	0.0015	0.0002
Lanthanum (La)	b, c, d, e	0.0019	0.0001
Lithium (Li)	b, c, d, e, g	(0.0007)	
Molybdenum (Mo)	b, c, d, e	0.0031	0.0002
Sodium (Na)	b, d, g	(0.0006)	
Phosphorus (P)	c, d, e	0.0006	0.0003
Lead (Pb)	b, c, d, e	0.0015	0.0001
Antimony (Sb)	c, e	0.0003	0.0002
Selenium (Se)	e	(< 0.0002)	
Tin (Sn)	b, c, d, e	0.0018	0.0002
Strontium (Sr)	a, b, c, d, e	(0.0011)	
Vanadium (V)	a, b, c, d, e	0.0009	0.0002
Tungsten (W)	b, c, d, e	0.0008	0.0002
Zirconium (Zr)	b, c, d, e	0.0015	0.0001

- 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) The half width confidence interval C(95%) is an expression of the uncertainty of the certified value, where  $C(95\%) = (t \times S_M / \sqrt{n})$  and "t" is the appropriate two sided Student's t value at the 95% confidence level for "n" acceptable mean values.

Values in brackets ( ) are not certified but given for information only.

**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
- d ICP-MS, digestion with acid
- e ICP-MS, closed vessel digestion with acid
- f Spectrophotometry
- g FAAS, digestion with acid
- h CV-AAS, closed vessel 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.

## 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.

## Description of Sample

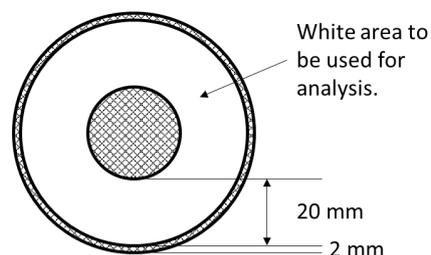
This reference material is available in the form of discs (approx. 68mm diameter and 25mm height)

## 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 between 2mm and 22mm from the edge of the CRM face. For wet chemical analysis chips have to be prepared by turning or milling of the sample surface.



## 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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