SUISSE TECHNOLOGY PARTNERS

Reference Material Certificate

122/09

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

Certified Values

Element	Analytical methods used for certification	Mass fraction [1] in [%]	Uncertainty [2] in mass fraction [%]
Silicon (Si)	a, h	0.0558	0.0021
Iron (Fe)	a, b, c, d, e, f, i	0.0515	0.0008
Copper (Cu)	a, b, c, d, e, f	0.0199	0.0003
Manganese (Mn)	a, b, c, d, e, f	0.0202	0.0004
Magnesium (Mg)	a, b, c, d, e	0.0173	0.0004
Chromium (Cr)	a, b, c, d, e, f	0.0196	0.0006
Nickel (Ni)	a, b, c, d, e, f	0.0205	0.0004
Zinc (Zn)	a, b, c, d, e	0.0197	0.0004
Titanium (Ti)	a, b, c, d, e, i	0.0192	0.0005
Silver (Ag)	b, d	0.0198	0.0007
Arsenic (As)	b, c, e	0.0054	0.0006
Boron (B)	b, d	0.0002	0.0002
Barium (Ba)	a, b, c, d, e	0.0054	0.0002
Beryllium (Be)	a, b, c, d, e	0.00048	0.00003
Bismuth (Bi)	a, b, c, e	0.0096	0.0003
Calcium (Ca)	b, c	< 0.0002	-
Cadmium (Cd)	a, b, c, d, e, f	0.0051	0.0001
Cerium (Ce)	a, b, c, d, e	0.0096	0.0007
Cobalt (Co)	a, b, c, e	0.0169	0.0004
Gallium (Ga)	a, b, c, d, e	0.0195	0.0005
Mercury (Hg)	c, d, e, k	0.0056	0.0004
Indium (In)	a, b, c, d	0.0099	0.0003
Lanthanum (La)	a, b, c, d, e	0.0151	0.0003
Lithium (Li)	b, c, d, e	0.00055	0.00005
Molybdenum (Mo)	a, b, c, e	0.0104	0.0002

Element	Analytical methods used for certification	Mass fraction [1] in [%]	Uncertainty [2] in mass fraction [%]
Sodium (Na)	b, d, f	0.0019	0.0003
Phosphorus (P)	b, c, d	0.0048	0.0003
Lead (Pb)	a, b, c, d, e, f	0.0095	0.0003
Antimony (Sb)	b, c, e, l	0.0094	0.0006
Scandium (Sc)	b, c, d, e	0.0018	0.0001
Tin (Sn)	b, c, e	0.0097	0.0004
Strontium (Sr)	a, b, c, d, e	0.0011	0.0001
Tantalum (Ta)	b, c, g	0.0007	0.0001
Thallium (Tl)	b, d, e	0.0090	0.0003
Vanadium (V)	a, b, c, e	0.0188	0.0004
Tungsten (W)	b, c, e, l	0.0093	0.0003
Zirconium (Zr)	a, b, c, e, l	0.0145	0.0005

[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
d	ICP-MS, digestion with acid
e	ICP-MS, closed vessel digestion with acid
f	FAAS, digestion with acid
g	Spark OES, solid sample analysis
h	Spectrophotometry, digestion with caustic soda
i	Spectrophotometry, digestion with acid
k	CV-AAS, closed vessel digestion with acid
l	ICP-MS, digestion with hydrofluoric acid

Abbreviations

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

Manufacturing
This certified reference material is produced using six strand vertical continuous casting out of a single melt.

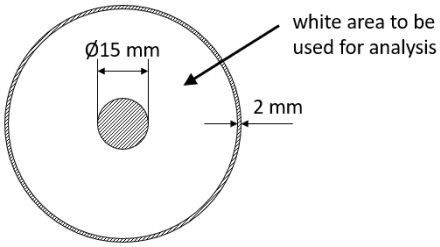
Analysis
The analysis of this material was performed in our ISO/IEC 17025 accredited analytical laboratory (STS 0023) by different established wet chemical procedures. Every certified value is the result of multiple independent analyses.

Homogeneity
Homogeneity testing is performed by means of spark optical 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% - 1.5% for alloying and other elements (Si, Fe, Cu, Mn, Mg, Cr, Ni, Zn, Ti, Be, Cd and V) and 1.5% - 7% for trace elements (all elements with mass fraction <0.01%). The homogeneity within one sample and between discs (cast homogeneity) 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. It may be used for instrument calibration, validation of analytical methods and drift correction over time. The material will remain stable for the period given below (certificate validity) if it is stored in a dry (non-condensing) and clean environment at room temperature (≤40 °C).

Instructions for Use
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. The minimum mass to be used is 0.2 g. For spark OES analysis, the surface of the material needs to be prepared by milling. The minimum area to be analyzed for spark OES and XRF analysis is 30 mm^2.



Traceability
Traceability of the certified mass fractions to the SI (Système International d'Unités) is ensured by calibration using certified standard solutions.

Accreditation
Suisse Technology Partners Ltd. is accredited as a producer of reference materials and certified reference materials according to ISO 17034 (SRMS 0006). This material was produced according to the rules of ISO 17034 and analyzed in our own laboratories accredited according to ISO/IEC 17025 (STS 0023). This material is an accredited certified reference material according to ISO 17034 (SRMS 0006).

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ISO 17034 (SRMS 0006)

Date of certification: 06-Dec-2022
Certificate version 002: 10-Mar-2023
This certificate is valid until: Dec / 2047