

Bundesanstalt für Materialforschung und -prüfung (BAM)

in cooperation with the Committee of Chemists of the GDMB
Gesellschaft der Metallurgen und Bergleute e.V.

Certified Reference Material

BAM-M318

AlSi1,2Mg0,4

Certified Values

Element	Mass fraction ¹⁾ in %	Uncertainty ²⁾ in %
Si	1.211	0.017
Fe	0.246	0.008
Cu	0.0908	0.0025
Mn	0.0985	0.0017
Mg	0.356	0.009
Cr	0.0208	0.0004
Zn	0.0486	0.0011
Ti	0.0238	0.0010
Ga	0.0189	0.0005
V	0.0104	0.0003
	in mg/kg	in mg/kg
Ni	50.0	1.9
Be	4.7	0.3
Ca	9.1	1.6
Cd	9.6	1.2
Hg	7.6	1.1
Li	6.0	0.7
Pb	56	3
Sn	20.6	1.1
Zr	32.9	1.4

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 laboratory and/or a different method of measurement.

²⁾ Estimated expanded uncertainty U with a coverage factor of $k = 2$, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the Expression of Uncertainty in Measurement, (GUM, ISO/IEC Guide 98-3:2008).

This certificate is valid until 02/2049.

Values for information

Element	Mass fraction ¹⁾ in mg/kg	Uncertainty ²⁾ in mg/kg
Na	3.7	1.3
B	< 2	---

¹⁾ Values were not certified, but given for information, when the number of accepted data sets was considered to be too low (< 5) or when the uncertainty from the inter-laboratory certification was considerably larger than the expected range or in case there were hints that the material was not homogeneous enough.

²⁾ Estimated expanded uncertainty *U* with a coverage factor of *k* = 2, corresponding to a level of confidence of approx. 95 %, as defined in the Guide to the expression of uncertainty in measurement, (GUM, ISO/IEC Guide 98-3:2008).

Sample Description

The Reference Material is available in the form of discs (approx. 65 mm diameter and 30 mm height).

Recommended Use

The CRM is intended for establishing or checking the calibration of spark optical emission and X-ray spectrometers for the analysis of samples of similar matrix composition. The minimum sample size for wet chemical analysis is 0.2 g.

Instructions for Use

Before use, the surface of the material must be prepared by milling or turning on a lathe. For wet chemical analysis chips have to be prepared by turning or milling of the sample surface.

An area 8mm in diameter in the centre of the discs should be avoided for spark optical emission spectrometry.

Transport and Storage

The material should be stored in a dry and clean environment at room temperature. Transport under normal ambient conditions.

Participating Laboratories

ALERIS Rolled Products Germany GmbH, Koblenz, Germany
AMAG Austria Metall AG, Ranshofen, Austria
Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany
Constellium, Centre de Recherches de Voreppe, Voreppe, France
Hydro Aluminium Rolled Products GmbH, R&D, Bonn, Germany
Hydro Aluminium Rolled Products GmbH, Hamburg, Germany
Institute of Non-Ferrous Metals, Gliwice, Poland
Leichtmetall Aluminium Giesserei Hannover GmbH, Hannover, Germany
Otto Fuchs KG, Meinerzhagen, Germany
Revierlabor, Essen, Germany
Suisse Technology Partners AG, Neuhausen, Switzerland
TRIMET Aluminium SE, Essen, Germany

Means of Accepted Data Sets

Certified values

Mass fraction in %

Mass fraction in mg/kg

Values for information

Mass fraction in mg/kg

Line No.	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Ga	V	Ni	Be	Ca	Cd	Hg	Li	Pb	Sn	Zr	Na	B
1	1.199	0.237	0.0882	0.0965	0.326	0.0203	0.0473	0.0229	---	0.0099	45.6	4.00	6.82	9.29	6.48	---	51.4	18.21	30.5	3.06	0.4
2	1.200	0.240	0.0884	0.0966	0.341	0.0204	0.0477	0.0231	0.0184	0.0101	48.2	4.06	8.37	9.34	7.00	5.55	52.9	18.88	30.6	3.29	< 1
3	1.205	0.242	0.0886	0.0975	0.342	0.0204	0.0477	0.0232	0.0186	0.0101	48.4	4.40	8.83	9.45	7.60	5.77	53.3	19.00	31.5	4.16	1.1
4	1.205	0.242	0.0896	0.0975	0.347	0.0205	0.0477	0.0232	0.0187	0.0101	48.9	4.57	10.04	9.52	7.83	5.95	53.6	20.57	31.6	4.33	< 2
5	1.205	0.244	0.0898	0.0978	0.352	0.0205	0.0477	0.0233	0.0187	0.0102	49.0	4.65	11.25	9.55	7.85	5.98	53.9	20.65	32.3		
6	1.205	0.244	0.0900	0.0980	0.354	0.0206	0.0480	0.0235	0.0188	0.0103	49.4	4.69		9.63	8.83	5.98	54.0	20.75	32.3		
7	1.205	0.244	0.0902	0.0980	0.354	0.0208	0.0481	0.0236	0.0189	0.0103	49.8	4.80		9.68		6.00	54.0	21.00	32.7		
8	1.212	0.244	0.0903	0.0981	0.355	0.0209	0.0482	0.0237	0.0189	0.0104	50.0	4.83		9.70		6.00	54.7	21.03	32.9		
9	1.215	0.245	0.0905	0.0982	0.355	0.0209	0.0483	0.0238	0.0189	0.0104	50.1	4.92		9.82		6.06	54.9	21.37	33.1		
10	1.216	0.247	0.0911	0.0982	0.356	0.0209	0.0486	0.0239	0.0191	0.0104	50.1	4.94		10.00		6.07	55.9	21.45	34.0		
11	1.219	0.248	0.0912	0.0984	0.357	0.0210	0.0488	0.0240	0.0192	0.0105	50.7	5.00		---		6.16	57.0	21.45	34.7		
12	1.222	0.249	0.0918	0.0985	0.360	0.0212	0.0495	0.0240	0.0193	0.0105	51.6	5.18					58.7	21.67	34.9		
13	1.231	0.249	0.0920	0.0987	0.364	0.0212	0.0501	0.0240		0.0105	52.5	5.29					60.4	22.33	36.7		
14		0.249	0.0922	0.0988	0.366	0.0212	0.0504	0.0241		0.0106	52.8						60.5				
15		0.250	0.0940	0.0989	0.379	0.0213	0.0505	0.0243		0.0107	53.5						62.3				
16		0.251	0.0943	0.0998	0.393	0.0213		0.0247		0.0108											
17		0.255		0.1017																	
18				0.1019																	
<i>M</i>	1.211	0.246	0.0908	0.0985	0.356	0.0208	0.0486	0.0238	0.0189	0.0104	50.0	4.72	9.06	9.60	7.60	5.95	55.8	20.64	32.9	3.71	< 2
<i>s_M</i>	0.010	0.005	0.0018	0.0015	0.016	0.0004	0.0011	0.0006	0.0003	0.0003	2.1	0.39	1.69	0.22	0.81	0.18	3.3	1.22	1.8	0.63	
\bar{s}_i	0.006	0.0023	0.0013	0.0010	0.003	0.0002	0.0005	0.0004	0.0002	0.0002	1.0	0.05	1.53	0.25	0.44	0.12	1.7	1.12	0.7	0.13	

The laboratory mean values have been examined statistically to eliminate outlying values. Where a " --- " appears in the table it indicates that an outlying value has been omitted (Grubbs 95 %). A data set consists of at least 5 but usually 6 single values of one laboratory.

M : mean of laboratory means

s_M : standard deviation of laboratory means

\bar{s}_i : averaged repeatability standard deviation (square root of the mean of laboratory variances)

Analytical Method used for Certification

Element	Line Number	Method
Si	1	XRF
	2, 5, 6, 8, 9, 10, 11, 12, 13	ICP-OES, dissolution with NaOH
	3	Spectrophotometry
	4	ICP-OES, dissolution with acid
	7	Gravimetry
Fe	1, 4, 5, 14, 15	ICP-OES, dissolution with acid
	2, 3, 7, 8, 9, 10, 11, 13, 16	ICP-OES, dissolution with NaOH
	6	FAAS, dissolution with acid
	12	XRF
	17	Spectrophotometry
Cu	1	FAAS, dissolution with acid
	2, 3, 5, 6, 14	ICP-OES, dissolution with acid
	4, 7, 8, 9, 10, 11, 12, 13, 16	ICP-OES, dissolution with NaOH
	15	XRF
Mn	1, 2, 3, 4, 5, 7, 11, 12, 17	ICP-OES, dissolution with NaOH
	6	XRF
	8, 10, 13, 15, 18	ICP-OES, dissolution with acid
	9	FAAS, dissolution with acid
	14	Spectrophotometry
	16	ICP-MS, dissolution with acid
Mg	1, 4, 6, 7, 12	ICP-OES, dissolution with acid
	2, 3, 5, 8, 9, 10, 11, 15, 16	ICP-OES, dissolution with NaOH
	13	FAAS, dissolution with acid
	14	XRF
Cr	1, 6, 7, 11, 15	ICP-OES, dissolution with acid
	2	ICP-MS, dissolution with acid
	3	FAAS, dissolution with acid
	4, 5, 8, 9, 10, 12, 14, 16	ICP-OES, dissolution with NaOH
	13	XRF
Zn	1, 5, 13, 14	ICP-OES, dissolution with acid
	2, 3, 4, 6, 7, 9, 10, 11, 15	ICP-OES, dissolution with NaOH
	8	XRF
	12	FAAS, dissolution with acid
Ti	1, 3, 4, 6, 11	ICP-OES, dissolution with acid
	2, 5, 7, 10, 12, 13, 14, 15, 16	ICP-OES, dissolution with NaOH
	8	Spectrophotometry
	9	ICP-MS, dissolution with acid
	17	XRF
Ga	2, 4, 5, 6, 7, 9, 10	ICP-OES, dissolution with NaOH
	3, 8, 11, 12	ICP-OES, dissolution with acid
V	1, 5, 9, 12, 14, 16	ICP-OES, dissolution with acid
	2	ICP-MS, dissolution with acid
	3	Spectrophotometry
	4, 6, 7, 8, 10, 11, 13	ICP-OES, dissolution with NaOH
	15	XRF

Element	Line Number	Method
Ni	1, 3, 4, 5, 8, 14 2 6, 9, 10, 11, 12, 13, 15 7	ICP-OES, dissolution with acid FAAS, dissolution with acid ICP-OES, dissolution with NaOH ICP-MS, dissolution with acid
Be	1, 3, 4, 5, 6, 10 2, 7, 8, 9, 11, 12 13	ICP-OES, dissolution with acid ICP-OES, dissolution with NaOH ICP-MS, dissolution with acid
Ca	1, 2, 4, 5 3	ICP-OES, dissolution with acid ICP-OES, dissolution with NaOH
Cd	1, 2, 3, 10 4, 6, 7, 8 5, 9	ICP-OES, dissolution with acid ICP-OES, dissolution with NaOH ICP-MS, dissolution with acid
Hg	1 2, 4, 6 3 5	ICP-MS, dissolution with acid ICP-OES, dissolution with acid CVAAS, dissolution with acid Atomic fluorescence, dissolution with acid
Li	2, 5, 10 3, 7, 8, 9, 11 4 6	ICP-OES, dissolution with NaOH ICP-OES, dissolution with acid Atomic emission, dissolution with acid ICP-MS, dissolution with acid
Pb	1 2, 3, 5, 7, 11, 14 6, 8, 10, 15 4, 9, 12 13	ETAAS, dissolution with acid ICP-OES, dissolution with NaOH ICP-OES, dissolution with acid ICP-MS, dissolution with acid XRF
Sn	1, 3, 4, 10, 12, 13 2, 5, 6, 7, 11 8, 9	ICP-OES, dissolution with acid ICP-OES, dissolution with NaOH ICP-MS, dissolution with acid
Zr	1, 6, 7, 8, 11, 12 2, 3, 5, 9, 10, 13 4	ICP-OES, dissolution with NaOH ICP-OES, dissolution with acid Spectrophotometry
<i>Na</i>	<i>1, 2, 3, 4</i>	<i>ICP-OES, dissolution with acid</i>
<i>B</i>	<i>1, 4 2 3</i>	<i>ICP-OES, dissolution with acid ICP-OES, dissolution with NaOH ICP-MS, dissolution with acid</i>

Abbreviations: CVAAS – Cold vapor atomic absorption spectrometry
ETAAS – Electrothermal atomic absorption spectrometry
FAAS – Flame atomic absorption spectrometry
ICP-OES – Inductively coupled plasma - optical emission spectrometry
ICP-MS – Mass spectrometry with inductively coupled plasma
XRF – X-ray fluorescence spectrometry

Metrological Traceability

To ensure traceability of the certified mass fractions to the SI (Système International d'Unités) calibration was performed using certified standard solutions or pure metals or substances of known stoichiometry.

Technical Report

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify BAM-M318 is available on request or can be downloaded from BAM website (www.bam.de).

Accepted as BAM-CRM on

Bundesanstalt für Materialforschung und -prüfung (BAM)

Dr. S. Richter
Committee for Certification

Dr. S. Recknagel
Project Coordinator

BAM holds an accreditation as a reference material producer according to ISO 17034. This accreditation is valid only for the scope as specified in the certificate D-RM-11075-01-00.

DAkkS is a signatory of the multilateral agreement (MLA) between EA, ILAC and IAF for mutual acceptance.



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