

# CERTIFICATE OF ANALYSIS

ERM<sup>®</sup>-EB314a

AlSi11Cu2Fe		
Element	Certified value <sup>1)</sup>	Uncertainty <sup>2)</sup>
Mass fraction in %		
Si	11.51	± 0.15
Fe	0.992	± 0.017
Cu	2.08	± 0.07
Mn	0.404	± 0.008
Mg	0.196	± 0.004
Cr	0.0574	± 0.0012
Ni	0.242	± 0.006
Zn	1.100	± 0.015
Ti	0.188	± 0.004
Pb	0.189	± 0.010
Sn	0.201	± 0.004
Mass fraction in mg/kg		
As	28	± 7
Be	4.65	± 0.22
Bi	92	± 6
Cd	5.2	± 1.0
Co	74	± 4
Ga	164	± 4
Sb	102	± 19
V	277	± 7
Zr	103	± 3

<sup>1)</sup> Unweighted mean value of the means of accepted sets of data, each set being obtained by at least 6 laboratories and/or with different methods of measurement. The values are traceable to the SI (Système International d'Unités) by the use of pure substances of known stoichiometry for calibration.

<sup>2)</sup> Estimated expanded uncertainty  $U$  with a coverage factor of  $k = 2$ , corresponding to a level of confidence of about 95 %, as defined in the ISO/IEC Guide 98-3:2008 [Uncertainty of measurement -- Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)].

This certificate is valid until 02/2066.

## DESCRIPTION OF THE SAMPLE

ERM-EB314a was prepared by atomisation of the melt in an inert gas stream with subsequent spray-compacting of the material. The Reference Material is available in the form of discs (50 mm diameter and 40 mm height).

Accepted as an ERM<sup>®</sup>, Berlin, 2016-02-08

BAM Department 1  
Analytical Chemistry;  
Reference Materials

BAM Division 1.6  
Inorganic Reference Materials

Prof. Dr. U. Panne  
(Head of Department)

Dr. S. Recknagel  
(Head of Division)

## NOTE

European Reference Material ERM<sup>®</sup>-EB314a was produced and certified under the responsibility of BAM Federal Institute for Materials Research and Testing in cooperation with the Committee of Chemists of the GDMB, Society for Mining, Metallurgy, Resource and Environmental Technology according to the principles laid down in the technical guidelines of the European Reference Materials<sup>®</sup> co-operation agreement between BAM-LGC-IRMM. Information on these guidelines is available on the Internet (<http://www.erm-crm.org>).

## INTENDED USE

The CRM is intended for establishing or checking the calibration of optical emission and X-ray spectrometers (excluding micro-analysis) for the analysis of samples of similar matrix composition. The minimum sample size for wet chemical analysis is 0.1 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.

## MEANS OF ACCEPTED DATA SETS

Certified values  
Mass fraction in %

Line no.	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Pb	Sn
1	11.21	0.971	2.008	0.394	0.190	0.0558	0.227	1.074	0.185	0.173	0.195
2	11.37	0.981	2.020	0.396	0.192	0.0560	0.231	1.074	0.185	0.176	0.198
3	11.42	0.982	2.037	0.401	0.192	0.0563	0.238	1.081	0.185	0.176	0.200
4	11.42	0.984	2.074	0.402	0.193	0.0564	0.239	1.095	0.186	0.178	0.200
5	11.43	0.987	2.076	0.403	0.194	0.0564	0.239	1.097	0.188	0.183	0.200
6	11.47	0.987	2.076	0.404	0.194	0.0570	0.240	1.107	0.189	0.194	0.201
7	11.49	0.988	2.094	0.405	0.197	0.0574	0.241	1.114	0.189	0.199	0.201
8	11.50	0.995	2.095	0.407	0.199	0.0574	0.241	1.115	0.191	0.201	0.201
9	11.58	0.996	2.103	0.407	0.199	0.0579	0.248	1.120	0.191	0.201	0.205
10	11.67	1.002	2.109	0.408	0.201	0.0581	0.248	1.122	0.194	0.211	0.205
11	11.76	1.004	2.114	0.410	0.206	0.0582	0.249	---			0.206
12	11.83	1.020	2.117	0.415		0.0597	0.252	---			
13		---				0.0601	0.252				
<i>M</i>	11.51	0.992	2.077	0.404	0.196	0.0574	0.242	1.100	0.188	0.189	0.201
<i>s<sub>M</sub></i>	0.18	0.013	0.037	0.006	0.005	0.0013	0.008	0.019	0.004	0.014	0.004
$\bar{s}_i$	0.08	0.008	0.014	0.004	0.003	0.0006	0.005	0.011	0.002	0.003	0.003

Certified values  
Mass fraction in mg/kg

Line no.	As	Be	Bi	Cd	Co	Ga	Sb	V	Zr
1	21.4	---	86.7	3.83	69.2	---	90.2	271.0	97.0
2	26.0	4.18	88.4	3.94	70.8	159.1	94.9	274.4	99.8
3	26.2	4.46	88.7	4.43	72.3	160.2	96.8	274.8	99.9
4	28.1	4.55	91.7	5.00	72.6	161.6	101.7	275.7	102.1
5	29.8	4.74	91.9	5.13	73.1	162.7	102.4	276.7	103.8
6	34.8	4.80	93.7	5.44	73.8	163.0	106.6	278.1	103.8
7		4.89	95.5	5.59	74.1	165.3	107.0	279.2	104.2
8		4.90	101.8	5.67	74.6	166.3	110.5	280.4	105.9
9			---	5.98	75.3	169.7	110.7	280.6	107.0
10				6.10	77.1	171.8		281.9	
11				6.55	77.9				
<i>M</i>	27.7	4.65	92.3	5.24	73.7	164.4	102.3	277.3	102.6
<i>s<sub>M</sub></i>	4.5	0.27	4.9	0.88	2.6	4.3	7.2	3.4	3.2
$\bar{s}_i$	1.4	0.05	6.2	0.29	0.8	1.6	1.7	3.9	1.6

The laboratory mean values have been examined statistically to eliminate outlying values. Each laboratory mean consists of at least 3 but usually 6 single values.

Where " --- " appears in the table it indicates that an outlying value has been omitted (Grubbs 95 %, Cochran 99 %).

*M* : mean of laboratory means

*s<sub>M</sub>* : 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 no.	Method
Si	1, 2, 3, 6, 7, 9, 10, 12	ICP-OES, dissolution with NaOH
	4, 8	Spectrophotometry
	5	Gravimetry
	11	XRF
Fe	1, 3, 6, 7, 9, 10, 12	ICP-OES, dissolution with NaOH
	2	XRF
	4, 11, 13	ICP-OES, dissolution with acid
	5	ICP-OES
	8	INAA
Cu	1, 3, 5, 7, 8, 9, 11	ICP-OES, dissolution with NaOH
	2	INAA
	4	ICP-OES
	6	XRF
	10, 12	ICP-OES, dissolution with acid
Mn	1, 7	ICP-OES, dissolution with acid
	2	INAA
	3, 4, 6, 8, 10, 11, 12	ICP-OES, dissolution with NaOH
	5	ICP-OES
	9	XRF
Mg	1, 6, 7, 9	ICP-OES, dissolution with acid
	2, 3, 4, 10, 11	ICP-OES, dissolution with NaOH
	5	ICP-OES
	8	XRF
Cr	1, 10, 12	ICP-OES, dissolution with acid
	2	INAA
	3, 4, 5, 8, 9, 11, 13	ICP-OES, dissolution with NaOH
	6	ICP-OES
	7	XRF
Ni	1	INAA
	2, 5, 6, 9, 10, 11, 12, 13	ICP-OES, dissolution with NaOH
	3	ICP-OES
	4, 7	ICP-OES, dissolution with acid
	8	XRF
Zn	1	XRF
	2, 12	ICP-OES, dissolution with acid
	3	INAA
	4, 5, 6, 8, 9, 10, 11	ICP-OES, dissolution with NaOH
	7	ICP-OES
Ti	1	ICP-OES
	2, 3, 4, 6, 7, 8	ICP-OES, dissolution with NaOH
	5	XRF
	9, 10	ICP-OES, dissolution with acid
Pb	1, 5, 6, 9	ICP-OES, dissolution with NaOH
	2, 3, 4, 7	ICP-OES, dissolution with acid
	8	ICP-OES
	10	INAA

Element	Line no.	Method
Sn	1	XRF
	2, 4, 5, 7, 8, 9, 11	ICP-OES, dissolution with NaOH
	3, 10	ICP-OES, dissolution with acid
	6	ICP-OES
As	1, 2, 3	ICP-OES, dissolution with acid
	4	INAA
	5	ICP-MS
	6	ICP-OES
Be	2, 3, 4	ICP-OES, dissolution with acid
	5	ICP-OES
	6, 7, 8	ICP-OES, dissolution with NaOH
Bi	1, 5	ICP-OES, dissolution with acid
	2, 3, 6, 8	ICP-OES, dissolution with NaOH
	4	ICP-OES
	7	ICP-MS, dissolution with acid
Cd	1, 4, 7	ICP-OES, dissolution with acid
	2	INAA
	3, 5, 8, 11	ICP-OES, dissolution with NaOH
	6	ICP-OES
	9	GFAAS
	10	ICP-MS, dissolution with acid
Co	1, 2, 7, 8	ICP-OES, dissolution with acid
	3	INAA
	4	ICP-MS, dissolution with acid
	5	ICP-OES
	6, 9, 10, 11	ICP-OES, dissolution with NaOH
Ga	2	INAA
	3	ICP-OES
	4	ICP-MS, dissolution with acid
	5, 6, 8, 9	ICP-OES, dissolution with NaOH
	7, 10	ICP-OES, dissolution with acid
Sb	1, 5, 8	ICP-OES, dissolution with NaOH
	2, 3, 9	ICP-OES, dissolution with acid
	4	ICP-OES
	6	INAA
	7	ICP-MS
V	1, 2, 7	ICP-OES, dissolution with NaOH
	3	XRF
	4	ICP-OES
	5, 6, 8, 9, 10	ICP-OES, dissolution with acid
Zr	1	XRF
	2, 4, 5, 7	ICP-OES, dissolution with NaOH
	3, 8, 9	ICP-OES, dissolution with acid
	6	ICP-OES

**Abbreviations:**

ICP-OES:	Inductively coupled plasma optical emission spectrometry
INAA:	Instrumental neutron activation analysis
GFAAS:	Graphite furnace atomic absorption spectrometry
ICP-MS:	Inductively coupled plasma mass spectrometry
XRF:	X-ray fluorescence spectrometry

## STORAGE

The material should be stored in a dry and clean environment at room temperature (approx. 20 °C).

## PARTICIPANTS

Suisse Technology Partners AG, Neuhausen, Switzerland  
Constellium, Centre de Recherches de Voreppe, Voreppe, France  
AMAG Austria Metall AG, Ranshofen, Austria  
BAM Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany  
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  
TRIMET Aluminium SE, Essen, Germany

## TECHNICAL REPORT

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify ERM<sup>®</sup>-EB314a is available on request or can be downloaded from BAM website ([www.bam.de/en/fachthemen/referenzmaterialien/index.htm](http://www.bam.de/en/fachthemen/referenzmaterialien/index.htm)).

Supply of this Reference Material by:

Federal Institute for Materials Research and Testing (BAM)  
Richard-Willstätter-Str. 11, D-12489 Berlin, Germany

Phone: +49 30 8104 2061

e-mail: [sales.crm@bam.de](mailto:sales.crm@bam.de)

Fax: +49 30 8104 1117

internet: [www.bam.de](http://www.bam.de)