in cooperation with the WG 'Aluminium'
of the Committee of Chemists of GDMB

CERTIFICATE OF ANALYSIS

ERM®-EB307a

AlMg4,5Mn		
	Certified value [1]	Uncertainty [2]
Element	Mass fraction in %	
Si	0.152	0.005
Fe	0.345	0.007
Cu	0.0939	0.0026
Mn	0.811	0.010
Mg	4.80	0.09
Cr	0.1536	0.0026
Ni	0.0097	0.0005
Zn	0.0690	0.0016
Ti	0.0595	0.0016
Pb	0.0084	0.0004
Sn	0.0075	0.0004
Ga	0.0124	0.0005
V	0.0119	0.0004
	Mass fraction in mg/kg	
Be	5.37	0.16
Ca	19.2	2.8
Cd	32.6	1.4
Co	5.1	0.5
Li	8.1	0.5
Sb	46	6
Zr	31.9	1.2

[1] Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination. The values are traceable to the SI (Système International d'Unités) by the use of pure substances of known stoichiometry for calibration.

[2] Estimated expanded uncertainty U with a coverage factor of $k = 2$ (Ca: $k = 3$; Co, Li: $k = 2.5$), 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 09/2066.

DESCRIPTION OF THE SAMPLE

ERM-EB307a was prepared by casting. The Certified Reference Material (CRM) is available in the form of discs (65 mm diameter and 30 mm height).

Accepted as an ERM®, Berlin, 2016-09-09

BAM Department 1
Analytical Chemistry;
Reference Materials

BAM Division 1.6
Inorganic Reference Materials

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Indicative Values

	Indicative value [1)]	Uncertainty [2)]
Element	Mass fraction in mg/kg	
Hg	34	5
Na	8.4	2.4

Indicative values were not certified, nevertheless given for information, when the number of accepted data sets was considered to be too low (< 5), when the uncertainty from the inter-laboratory certification was considerably larger than the expected range or when only an upper limit can be given.

[1)] Unweighted mean value of the means of accepted sets of data, each set being obtained in a different laboratory and/or with a different method of determination. The values are traceable to the SI (Système International d'Unités) by the use of pure substances of known stoichiometry for calibration.

[2)] Estimated expanded uncertainty U with a coverage factor of $k = 2$ (Na: $k = 2.5$), 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)].

Two laboratories determined Boron and found 0.3 mg/kg and 1.6 mg/kg respectively.

NOTE

European Reference Material ERM®-EB307a was produced and certified under the responsibility of Bundesanstalt für Materialforschung und -prüfung (BAM) in cooperation with the Committee of Chemists of GDMB Society of Metallurgists and Miners according to the principles laid down in the technical guidelines of the European Reference Materials® 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.

STORAGE

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

PARTICIPANTS

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MEANS OF ACCEPTED DATA SETS

Certified values
Mass fraction in %

Line no.	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Pb	Sn	Ga	V
1	0.143	0.339	0.0914	0.795	4.747	0.1515	0.0093	0.0673	0.0564	0.0078	0.0069	0.0118	0.0114
2	0.147	0.339	0.0919	0.796	4.758	0.1519	0.0094	0.0676	0.0565	0.0082	0.0069	0.0120	0.0115
3	0.148	0.340	0.0925	0.797	4.762	0.1521	0.0094	0.0681	0.0584	0.0083	0.0071	0.0122	0.0115
4	0.149	0.343	0.0933	0.800	4.768	0.1523	0.0095	0.0683	0.0586	0.0084	0.0072	0.0122	0.0116
5	0.152	0.344	0.0936	0.802	4.800	0.1527	0.0096	0.0685	0.0589	0.0084	0.0073	0.0125	0.0117
6	0.153	0.344	0.0938	0.810	4.804	0.1535	0.0096	0.0688	0.0593	0.0084	0.0076	0.0127	0.0120
7	0.154	0.344	0.0942	0.814	4.813	0.1539	0.0097	0.0694	0.0595	0.0085	0.0076	0.0128	0.0120
8	0.154	0.345	0.0943	0.814	4.814	0.1545	0.0100	0.0696	0.0602	0.0085	0.0077	0.0130	0.0120
9	0.155	0.346	0.0945	0.820	4.829	0.1546	0.0100	0.0698	0.0606	0.0086	0.0077		0.0121
10	0.156	0.347	0.0948	0.821	4.839	0.1550	0.0100	0.0701	0.0607	0.0089	0.0079		0.0122
11	0.157	0.348	0.0963	0.831	4.846	0.1555	0.0100	0.0701	0.0611		0.0082		0.0122
12		0.350	0.0968	0.832	4.874	0.1559	0.0101	0.0705	0.0612				0.0122
13		0.351							0.0620				
14		0.352											
M	0.152	0.345	0.0939	0.811	4.805	0.1536	0.0097	0.0690	0.0595	0.0084	0.0075	0.0124	0.0119
s_M	0.0044	0.0043	0.0016	0.014	0.040	0.0015	0.0003	0.0011	0.0017	0.0003	0.0004	0.0004	0.0004
$\overline{s_i}$	0.0017	0.0036	0.0014	0.009	0.054	0.0021	0.0002	0.0008	0.0005	0.0001	0.0002	0.0002	0.0001

	Certified values Mass fraction in mg/kg								Indicative value Mass fraction in mg/kg	
Line no.	**Be**	**Ca**	**Cd**	**Co**	**Li**	**Sb**	**Zr**		***Hg***	***Na***
1	5.29	16.5	31.6	4.73	7.52	43.8	30.7		*32.4*	*6.24*
2	5.29	18.4	31.9	4.80	7.91	44.5	31.1		*32.4*	*7.60*
3	5.32	19.0	32.2	4.99	8.00	45.0	31.5		*33.8*	*8.17*
4	5.38	20.2	32.3	5.01	8.05	45.2	31.7		*36.9*	*9.97*
5	5.40	21.6	32.4	5.10	8.10	46.9	31.8			*10.11*
6	5.43		33.0	5.40	8.45	47.9	32.0			
7	5.49		33.8	5.55	8.92	48.5	32.1			
8			33.9				32.2			
9							32.4			
10							32.5			
11							32.6			
12										
13										
14										
M	5.37	19.2	32.6	5.08	8.14	46.0	31.9		*33.9*	*8.42*
s_M	0.08	2.0	0.9	0.30	0.44	1.78	0.61		*2.2*	*1.65*
$\bar{s}_i$	0.08	1.4	0.4	0.08	0.16	1.78	1.24		*1.4*	*0.51*

The laboratory mean values have been examined statistically to eliminate outlying values. Each laboratory mean consists of at least 4 but usually 6 single values.

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 no.	Method
Si	1	XRF
	2, 3, 4, 6, 9, 10, 11	ICP-OES, dissolution with NaOH
	5, 8	Spectrophotometry
	7	Gravimetry
Fe	1, 3, 6, 7, 12	ICP-OES, dissolution with NaOH
	2	ICP-MS, dissolution with acid
	4, 8, 11, 13, 14	ICP-OES, dissolution with acid
	9, 10	XRF
	5	Spectrophotometry
Cu	1	ICP-MS, dissolution with acid
	2, 5	XRF
	3, 9, 10, 12	ICP-OES, dissolution with NaOH
	4, 7, 8, 11	ICP-OES, dissolution with acid
	6	FAAS, dissolution with acid

Element	Line no.	Method
Mn	1, 2, 3, 4, 11	ICP-OES, dissolution with acid
	5, 6, 7, 9, 10	ICP-OES, dissolution with NaOH
	8, 12	XRF
Mg	1, 3	XRF
	2, 4, 6, 8	ICP-OES, dissolution with NaOH
	5, 7, 9, 10, 11, 12	ICP-OES, dissolution with acid
Cr	1, 12	XRF
	2, 4, 5, 7, 11	ICP-OES, dissolution with acid
	3, 6, 8, 9	ICP-OES, dissolution with NaOH
	10	ICP-MS, dissolution with acid
Ni	1, 6, 8, 10, 12	ICP-OES, dissolution with acid
	2	XRF
	3, 5, 7, 9, 11	ICP-OES, dissolution with NaOH
	4	ICP-MS, dissolution with acid
Zn	1, 4, 7, 9	ICP-OES, dissolution with NaOH
	2, 8	XRF
	3, 6, 10, 11, 12	ICP-OES, dissolution with acid
	5	ICP-MS, dissolution with acid
Ti	1, 4, 6, 10, 13	ICP-OES, dissolution with acid
	2, 3, 7, 8, 9	ICP-OES, dissolution with NaOH
	5	Spectrophotometry
	11	XRF
	12	ICP-MS, dissolution with acid
Pb	1	XRF
	2, 5, 6, 9	ICP-OES, dissolution with acid
	3, 7	ICP-MS, dissolution with acid
	4, 8, 10	ICP-OES, dissolution with NaOH
Sn	1, 5, 6, 7, 8	ICP-OES, dissolution with acid
	2, 9	ICP-MS, dissolution with acid
	3, 4, 11	ICP-OES, dissolution with NaOH
	10	XRF
Ga	1, 2, 5, 7, 8	ICP-OES, dissolution with acid
	3, 6	ICP-OES, dissolution with NaOH
	4	ICP-MS, dissolution with acid
V	1, 6, 7, 8	ICP-OES, dissolution with NaOH
	2, 9, 11	ICP-MS, dissolution with acid
	3, 5, 10	ICP-OES, dissolution with acid
	4	Spectrophotometry
	12	XRF
Be	1, 3, 4	ICP-OES, dissolution with acid
	2, 7	ICP-MS, dissolution with acid
	5, 6	ICP-OES, dissolution with NaOH
Ca	1, 2, 4, 5	ICP-OES, dissolution with acid
	3	ICP-OES, dissolution with NaOH
Cd	1, 5, 8	ICP-MS, dissolution with acid
	2, 3, 6	ICP-OES, dissolution with acid
	4, 7	ICP-OES, dissolution with NaOH

Element	Line no.	Method
Co	1, 6	ICP-OES, dissolution with NaOH
	2, 3, 4	ICP-MS, dissolution with acid
	5, 7	ICP-OES, dissolution with acid
Li	1, 5, 6	ICP-OES, dissolution with acid
	2, 4	ICP-MS, dissolution with acid
	3, 7	ICP-OES, dissolution with NaOH
Sb	1, 2, 3, 7	ICP-OES, dissolution with acid
	4, 5	ICP-MS, dissolution with acid
	6	ICP-OES, dissolution with NaOH
Zr	1	XRF
	2	Spectrophotometry
	3, 6, 8, 9, 11	ICP-OES, dissolution with acid
	4, 5, 7	ICP-OES, dissolution with NaOH
	10	ICP-MS, dissolution with acid
Hg	*1*	*CVAAS*
	2, 4	*ICP-MS, dissolution with acid*
	3	*ICP-OES, dissolution with NaOH*
Na	*1*	*ICP-MS, dissolution with acid*
	2, 3, 4, 5	*ICP-OES, dissolution with acid*

Abbreviations:

CVAAS:	Cold vapour atomic absorption spectrometry
ICP-OES:	Inductively coupled plasma optical emission spectrometry
FAAS:	Flame atomic absorption spectrometry
ICP-MS:	Inductively coupled plasma mass spectrometry
XRF:	X-ray fluorescence spectrometry

TECHNICAL REPORT

A detailed technical report describing the analysis procedures and the treatment of the analytical data used to certify ERM®-EB307a is available on request or can be downloaded from BAM website (www.bam.de).

Supply of this Reference Material by:

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