

# CERTIFICATE OF ANALYSIS

## ERM<sup>®</sup>-EB312a

<b>AlMgSi0,5</b>		
	Certified value <sup>1)</sup>	Uncertainty <sup>2)</sup>
Element	Mass fraction in %	
Si	0.403	0.008
Fe	0.198	0.004
Cu	0.0509	0.0014
Mn	0.0488	0.0011
Mg	0.379	0.004
Cr	0.0320	0.0009
Zn	0.0297	0.0008
Ti	0.0291	0.0011
Ga	0.0129	0.0003
	Mass fraction in mg/kg	
Ni	40.7	2.4
Bi	18.0	1.8
Cd	16.7	1.3
Li	6.0	1.1
Pb	49.7	2.1
Sr	11.1	0.7
V	67.3	1.4
Zr	8.5	0.7
<p><sup>1)</sup> 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. All values were confirmed in an inter-laboratory comparison using spark optical emission spectrometry.</p> <p><sup>2)</sup> Estimated expanded uncertainty <i>U</i> with a coverage factor of <i>k</i> = 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)].</p>		

This certificate is valid until 04/2067.

### DESCRIPTION OF THE SAMPLE

ERM-EB312a was prepared by casting. The Certified Reference Material (CRM) is available in the form of discs (65 mm diameter and 30 mm height).

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Analytical Chemistry;  
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<b>Informative Values</b>		
<b>Element</b>	<b>Mass fraction <sup>1)</sup> in mg/kg</b>	<b>Uncertainty <sup>2)</sup> in mg/kg</b>
B	2.7	1.0
Ca	16.9	2.5
Na	4.0	1.8

Indicative values were not certified, nevertheless 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.

<sup>1)</sup> 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. All values were confirmed in an inter-laboratory comparison using spark optical emission spectrometry.

<sup>2)</sup> Estimated expanded uncertainty  $U$  with a coverage factor of  $k = 3$  (B:  $k = 2$ ), 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)].

## NOTE

European Reference Material ERM®-EB312a 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-JRC. 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 spark optical emission and X-ray fluorescence spectrometers (excluding micro-analysis) 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.

## STORAGE

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

## PARTICIPANTS

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 Hydro Aluminium Rolled Products GmbH, R&D, Bonn, Germany  
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## MEANS OF ACCEPTED DATA SETS

Certified values  
 Mass fraction in %

Line no.	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Ga
1	0.395	0.1948	0.0484	0.0458	0.375	0.0304	0.0281	0.0287	0.0125
2	0.396	0.1955	0.0495	0.0465	0.376	0.0309	0.0292	0.0290	0.0127
3	0.399	0.1961	0.0501	0.0483	0.377	0.0314	0.0293	0.0291	0.0127
4	0.401	0.1964	0.0502	0.0486	0.378	0.0315	0.0294	0.0291	0.0128
5	0.404	0.1970	0.0507	0.0486	0.379	0.0320	0.0294	0.0291	0.0130
6	0.405	0.1975	0.0517	0.0488	0.380	0.0321	0.0295	0.0291	0.0131
7	0.411	0.1977	0.0519	0.0491	0.382	0.0325	0.0298	0.0293	0.0131
8	0.415	0.2000	0.0521	0.0495	0.383	0.0326	0.0298	0.0293	0.0131
9		0.2003	0.0521	0.0497	0.384	0.0328	0.0302	0.0293	0.0133
10		0.2013	0.0525	0.0502	---	0.0329	0.0302	0.0294	
11				0.0516		0.0329	0.0303		
12							0.0307		
13									
$M$	0.403	0.1977	0.0509	0.0488	0.379	0.0320	0.0297	0.0291	0.0129
$s_M$	0.0072	0.0022	0.0014	0.0016	0.0030	0.0009	0.0007	0.0002	0.0003
$\bar{s}_i$	0.0024	0.0014	0.0003	0.0006	0.0041	0.0004	0.0003	0.0003	0.0003

Line no.	Certified values Mass fraction in mg/kg								Indicative value Mass fraction in mg/kg		
	Ni	Bi	Cd	Li	Pb	Sr	V	Zr	B	Ca	Na
1	39.00	16.18	16.09	5.70	47.27	10.57	66.2	7.45	2.07	15.6	3.40
2	39.03	17.05	16.33	5.78	47.30	10.76	66.3	8.13	2.18	16.8	3.60
3	39.74	17.33	16.43	5.82	48.07	10.81	66.4	8.25	2.37	18.2	5.05
4	39.93	17.68	16.53	5.91	48.87	10.83	66.7	8.31	2.85		
5	39.96	17.75	16.55	6.12	49.37	11.07	66.7	8.33	2.95		
6	40.28	18.30	16.60	6.35	49.43	11.13	66.8	8.42	3.60		
7	41.40	18.47	16.65	6.35	49.53	11.53	66.9	8.50			
8	41.60	19.64	16.87		49.96	12.17	67.4	8.57			
9	42.20	19.84	17.00		51.04		68.1	8.60			
10	42.50		17.03		52.56		68.3	8.63			
11	42.50		17.03		52.75		68.3	9.05			
12			17.18				68.4	9.32			
13							68.5				
<i>M</i>	40.74	18.03	16.69	6.00	49.65	11.11	67.3	8.46	2.67	16.9	4.02
<i>s<sub>M</sub></i>	1.34	1.19	0.34	0.28	1.86	0.52	0.89	0.47	0.58	1.4	0.90
$\bar{s}_i$	1.02	0.60	0.26	0.13	1.02	0.39	1.55	0.22	0.20	0.7	0.35

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. Each laboratory mean consists of at least 5 but usually 6 single values.

*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	ICP-OES, dissolution with acid
	2, 3, 4, 6, 7	ICP-OES, dissolution with NaOH
	8	XRF
	5	Spectrophotometry
Fe	1, 2, 3, 4, 6, 10	ICP-OES, dissolution with NaOH
	5, 9	ICP-OES, dissolution with acid
	7	Spectrophotometry
	8	XRF
Cu	1	ICP-MS, dissolution with acid
	2, 5, 10	ICP-OES, dissolution with acid
	3, 4, 6, 7, 9	ICP-OES, dissolution with NaOH
	8	XRF
Mn	1, 8, 9	ICP-OES, dissolution with acid
	2, 3, 6, 7, 10, 11	ICP-OES, dissolution with NaOH
	4	ICP-MS, dissolution with acid
	5	XRF

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

Element	Line no.	Method
Zr	1	XRF
	2, 5	ICP-MS, dissolution with acid
	3, 6, 8, 11, 12	ICP-OES, dissolution with acid
	4	Spectrophotometry
	7, 9, 10	ICP-OES, dissolution with NaOH
B	1, 3	<i>ICP-OES, dissolution with acid</i>
	2	<i>ICP-OES, dissolution with NaOH</i>
	4, 5, 6	<i>ICP-MS, dissolution with acid</i>
Ca	1, 2, 3	<i>ICP-OES, dissolution with acid</i>
Na	1, 2, 3	<i>ICP-OES, dissolution with acid</i>

#### Abbreviations:

ETAAS:	Electrothermal atomic absorption spectrometry
FAAS:	Flame atomic absorption spectrometry
ICP-OES:	Inductively coupled plasma optical emission 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<sup>®</sup>-EB312a is available on request or can be downloaded from BAM website ([www.bam.de](http://www.bam.de)).

Supply of this Reference Material by:

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BAM holds an accreditation as a reference material producer according to ISO Guide 34 in combination with ISO/IEC 17025. 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.

