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

CERTIFICATE OF ANALYSIS

ERM®-EB102a

PbCaSn

Certified Values			
	Certified value [1]	Uncertainty [2]	
Element	Mass fraction in %		
Ca	0.0635		0.0022
Sn	1.01	±	0.05
Element	Mass fraction in mg/kg		
Al	124	±	11
Ag	170	±	6
Bi	73.7	±	2.6
Cu	1.3	±	0.4
Tl	30.2	±	1.5

[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 measurement. The values are traceable to the SI (Système International d'Unités) via calibration using pure metals or substances of known stoichiometry.

[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, ISO, 1993.

This certificate is valid until 10/2059; this validity may be extended as further evidence of stability becomes available.

DESCRIPTION OF THE SAMPLE

The Reference Material is available in the form of discs (40 mm diameter and 40 mm height). It is intended for establishing and checking the calibration of optical emission and X-ray spectrometers (excluding micro-analysis) for the analysis of samples of similar materials.

NOTE

European Reference Material ERM®-EB102a 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, Gesellschaft für Bergbau, Metallurgie, Rohstoff- und Umwelttechnik 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).

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Indicative Values[1)]

	Indicative value [2)]	Uncertainty [3)]
Element	Mass fraction in mg/kg	
Sb	4	± 4
As	< 2	
In	< 2	
Te	< 1.1	
Zn	< 0.5	

[1)] Values were not certified, but given as indicative values, 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.

[2)] 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 measurement. The values are traceable to the SI (Système International d'Unités) via calibration using pure substances of known stoichiometry.

[3)] 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, ISO, 1993.

Additional Material Information [1)]

	Mean or upper limit	Std.-dev [2)]
Element	Mass fraction in mg/kg	
Fe	< 2	
Mg	< 1	
Na	4	± 1
S	< 3	

[1)] Values were obtained in an interlaboratory comparison with spark emission spectrometry.

[2)] Standard deviation calculated from the mean of means of the interlaboratory comparison with n = 6 for Fe, n = 4 for Mg, n = 8 for Na and n = 12 for S.

MEANS OF ACCEPTED DATA SETS

Certified values
Mass fraction in % Mass fraction in mg/kg

Line no.	Ca	Sn		Al	Ag	Bi	Cu	Tl
1	0.0582	---		111	165	67.0	0.56	28.7
2	0.0613	0.937		119	166	70.2	0.62	29.0
3	0.0616	0.962		119	167	70.7	0.84	29.1
4	0.0617	0.999		120	168	72.1	0.98	29.1
5	0.0622	1.011		121	168	72.2	1.00	29.6
6	0.0632	1.013		122	169	72.2	1.03	29.6
7	0.0633	1.016		126	171	74.7	1.20	31.1
8	0.0654	1.023		126	172	75.7	1.21	32.0
9	0.0662	1.028		127	172	76.1	1.45	33.3
10	0.0671	1.031		131	172	76.1	1.45	
11	0.0680	1.039		131	175	77.4	1.71	
12		1.040		133	178	79.7	1.79	
13		1.053					2.08	
14							2.09	
M :	0.0635	1.01		124	170	74	1.3	30.2
s_M:	0.0030	0.04		7	4	4	0.5	1.6
$\overline{s_i}$:	0.0008	0.008		2	2	1.21	0.19	1.1

Indicative values
Mass fraction in mg/kg

Sb	*As*	*In*	*Te*	*Zn*
0.62	*0.11*	*0.15*	*0.08*	*0.38*
0.94	*0.63*	*0.32*	*0.43*	*0.41*
1.03	*0.81*	*1.00*	*0.50*	*0.45*
2.13	*2.00*	*1.44*	*1.05*	*0.47*
5.08	*< 0.1*	*< 1*	*< 1.5*	*0.53*
6.87	*< 0.4*	*< 3*	*< 1*	*0.55*
8.87	*< 1*		*< 1*	---
< 1				*< 0.5*
< 2.5				*< 1*
3.5	*0.886*	*0.726*	*0.51*	*0.947*
3.3	*0.799*	*0.602*	*0.401*	*0.2882*
0.23	*0.075*	*0.055*	*0.101*	*0.128*

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. Where " --- " appears in the table it indicates that an outlying value has been omitted (Grubbs 99 %). " < "-values have not been considered in statistical evaluation.

M : mean of means of data sets $\overline{s_i}$: mean of standard deviations of data sets under repeatability conditions

s_M : standard deviation of means of data sets

TECHNICAL REPORT

A detailed technical report (in German) describing the analysis procedures and the treatment of the analytical data used to certify ERM®-EB102a is available on request.

ANALYTICAL METHOD USED FOR CERTIFICATION

Element	Line no.	Method
Ca	1, 8, 9	FAAS
	2, 3, 4, 5, 6, 7, 10 ,11	ICP-OES
Sn	2, 4, 5, 6, 7, 8, 9, 10, 11, 13	ICP-OES
	3, 12	FAAS
Al	1, 2, 4, 5, 6, 7, 9, 11, 12	ICP-OES
	3, 10	FAAS
	8	FAAS after separation of the matrix
Ag	1	FAAS after separation of the matrix
	2, 3, 5, 6, 7, 8, 9, 11, 13	ICP-OES
	4	ICP-MS
	10, 11, 12	FAAS
Bi	1, 2, 3, 6, 8, 9, 10, 11, 12	ICP-OES
	4, 5	FAAS
	7	ICP-MS
Tl	1, 2, 7, 8, 9	ICP-OES
	3, 4	FAAS
	5, 6	ICP-MS
Cu	1	ICP-OES after separation of the matrix
	2, 3, 5, 6, 8, 10, 11, 12	ICP-OES
	4, 9	ICP-MS
	7, 13	FAAS
	14	ETAAS
Sb	*1, 8*	*ICP-MS*
	2, 3, 4, 5, 6, 9	*ICP-OES*
	7	*FAAS*
As	*1*	*ICP-OES after separation of the matrix*
	2, 3, 6	*ICP-OES*
	4	*Spectrophotometry*
	5, 7	*ICP-MS*
In	*1*	*ICP-OES after separation of the matrix*
	2, 3, 4, 6	*ICP-OES*
	5	*ICP-MS*
Te	*1*	*ICP-OES after separation of the matrix*
	2, 3, 4, 5	*ICP-OES*
	6, 7	*ICP-MS*
Zn	*1, 2, 3, 4*	*ICP-OES*
	5	*ICP-MS*
	6	*ICP-OES after separation of the matrix*
	8, 9	*FAAS*

Abbreviations:

ICP-OES: Inductively coupled plasma optical emission spectrometry
ICP-MS: Inductively coupled plasma mass spectrometry
FAAS: Flame atomic absorption spectrometry
ETAAS: Electrothermal atomic absorption spectrometry

INTENDED USE

The CRM is intended for establishing and checking the calibration of optical emission and X-ray spectrometers (excluding micro-analysis) for the analysis of samples of similar materials. The minimum sample size for wet chemical analysis is 0.5 g.

INSTRUCTIONS FOR USE

Before use, the surface of the material must be prepared by milling or turning on a lathe.

STORAGE

The material should be stored in a dry and clean environment at room temperature.

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