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

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CERTIFICATE OF ANALYSIS

ERM®-EB101

PbCaSnAl

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Certified Values		
	Certified value [1]	Uncertainty [2]
Element	Mass fraction in %	
Ca	0.1436	± 0.0016
Sn	0.293	± 0.007
Al	0.0257	± 0.0006
Element	Mass fraction in mg/kg	
Ag	28.8	± 0.7
Bi	165	± 4
Cu	17.3	± 1.7

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

[2] Estimated expanded uncertainty *U* with a coverage factor of about *k*=2, corresponding to a level of confidence of 95 %, as defined in the Guide to the expression of uncertainty in measurement, ISO, 1993.

This certificate is valid until 09/2053; this validity may be extended as further evidence of stability becomes available.

The minimum sample size for wet chemical analysis is 0.5 g.

NOTE

European Reference Material ERM®-EB101 was originally certified as BAM-101 It was produced and certified under the responsibility of Bundesanstalt für Materialforschung und –prüfung (BAM) 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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DESCRIPTION OF THE SAMPLE

The Reference Material is available in the form of discs (50 mm diameter, 30 mm thickness). It is intended for establishing and checking the calibration of optical emission and X-ray spectrometers for the analysis of samples of similar materials.

MEANS OF ACCEPTED DATA SETS

(for one method at one laboratory, respectively)

mass fraction in %

Line no.	Ca	Sn	Al
1	0.1395	0.2733	-
2	0.1403	0.2800	-
3	0.1408	0.2810	0.0245
4	0.1423	0.2833	0.0246
5	0.1427	0.2872	0.0250
6	0.1432	0.2890	0.0251
7	0.1433	0.2953	0.0252
8	0.1449	0.3003	0.0258
9	0.1450	0.3024	0.0258
10	0.1451	0.3025	0.0261
11	0.1452	0.3040	0.0263
12	0.1454	0.3043	0.0267
13	0.1497	0.3070	0.0268
14	-		0.0270
M :	0.1436	0.293	0.0257
s_M :	0.0027	0.011	0.0009
$\bar{s}$:	0.0024	0.004	0.0004

mass fraction in mg/kg

Line no.	Bi	Ag	Cu
1	153.3	-	12.9
2	155.7	27.0	14.0
3	158.8	28.2	14.2
4	161.2	28.3	16.8
5	163.3	28.3	17.3
6	164.8	28.4	18.2
7	165.0	28.7	18.8
8	165.0	29.2	19.2
9	168.0	29.8	19.3
10	169.7	29.8	19.5
11	176.0	30.2	20.5
12	178.3	-	-
13	-		
14			
M :	165	28.8	17.3
s_M :	7	1.0	2.6
$\bar{s}$:	4	0.6	0.4

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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.

M : mean of means of data sets
s_M : standard deviation of means of data sets*
$\bar{s}$: mean of standard deviations of data sets

*calculated of at least 5 but usually 6 single values

ANALYTICAL METHOD USED FOR CERTIFICATION

Element	Line no.	Method
Ca	1, 5, 7, 9, 13	FAAS, without separation
	10	FAAS, separation of Pb as nitrate
	2, 3, 4, 6, 11, 12	ICP OES, without separation
	8	ICP OES, separation of Pb as nitrate
	14	ICP OES, separation of Pb as chloride
Sn	1, 2, 3, 4, 8	FAAS, without separation
	11	FAAS, separation of Pb as chloride
	5, 6, 9, 10, 12, 13	ICP OES, without separation
	7	Iodometric titration, separation as stannic acid and reduction with H_3PO_2
Al	9, 10, 11, 12, 14	FAAS, without separation
	1, 3, 5, 7, 8, 13	ICP OES, without separation
	6	ICP OES, separation of Pb as sulphate
	4	ICP OES, separation of Pb as chloride
	2	FAAS, separation of Pb as chloride
Ag	1, 6, 8, 9, 10, 12	FAAS, without separation
	5	ET AAS
	3	FAAS, separation of Pb as nitrate
	2, 4, 7, 11	ICP OES, without separation
Bi	1, 5, 7, 8, 10	FAAS, without separation
	2	FAAS, separation of Pb as nitrate
	11	FAAS, separation of Pb as chloride
	3, 4, 6, 9, 12, 13	ICP OES, without separation
Cu	4, 8, 9, 10, 11, 12	FAAS, without separation
	7	FAAS, separation of Pb as chloride
	1, 2, 5, 8	ICP OES, without separation
	6	ET AAS
	3	ICP OES, extraction with DDC

Abbreviations:

ET AAS:	Electrothermal Atomic Absorption Spectrometry
FAAS:	Flame Atomic Absorption Spectrometry
ICP OES:	Inductively Coupled Plasma – Optical Emission Spectrometry
DDC:	Diethyldithiocarbamate

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PARTICIPANTS

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Boliden Bergsöe AB, Landskrona (S)
Britannia Refined Metals, Bredhurst (UK)
BSB Recycling GmbH, Braubach (D)
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Norddeutsche Affinerie AG, Hamburg (D)
VB Autobatterie GmbH, Hannover (D)

INSTRUCTIONS FOR USE

Before use, the surface of the material must be cleaned by turning on a lathe.

STORAGE

The material should be stored at ambient conditions in a dry and clean environment.

TECHNICAL REPORT

A detailed technical report (in German) describing the analysis procedures and the treatment of the analytical data used to certify ERM®-EB101 is available on request.

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Supply of Reference Materials by Bundesanstalt für Materialforschung und –prüfung:

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