ARMI | MBH
ANALYTICAL LTD

Certified Reference Material | Certificate of Analysis

ISO 17034:2016 **ISO/IEC 17025:2017** **ISO 9001:2015**

Product ID: MBH-31X B25 C

Revision No.: 000
Revision Date: 03/25/2022

Product Description: Traces in Brass

Description and Intended Use: This **Certified Reference Material** is covered under the scope of accreditation to **ISO 17034** by LGC Standards - Manchester, NH. As an ISO 17034 certified reference material, appropriate use of this material will fulfill the certified reference material and traceability requirements for use in **ISO 17025** accredited laboratories. This CRM may come in the form of a solid disk, or chips. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods.

Certified Values listed in wt.% with associated uncertainties

Ag	0.0025 ± 0.0003	**Al**	0.48 ± 0.01	**As**	0.027 ± 0.001	**Bi**	0.061 ± 0.002
Cd	0.00019 ± 0.00008	**Cr**	0.0002 ± 0.0001	**Cu**	55.6 ± 0.2	**Fe**	0.014 ± 0.001
Mn	0.128 ± 0.003	**Ni**	0.255 ± 0.004	**P**	0.116 ± 0.008	**Pb**	0.272 ± 0.007
Sb	0.075 ± 0.004	**Si**	0.235 ± 0.006	**Sn**	0.62 ± 0.01	**Zn**	42.2 ± 0.2

Indicative Values listed in ppm

B	(20)	Co	(7)	Se	(7)

Homogeneity and Uncertainty: "Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental XRF results are reflected in both the overall statistics and certified data. Homogeneity samples are selected by a systematic sampling procedure. The number of samples may be determined by equation 1, where N_{prod} is the number of units produced and N_{min} is the number of samples used for homogeneity testing. These samples are arranged in a simple randomized design such that each sample is analyzed multiple times by XRF. Homogeneity may also be determined within sample using an applied version of ASTM E826. A single factor ANOVA is used to calculated uncertainty due to inhomogeneity (U_{hom}). Uncertainty of the material is calculated by equation 2, where H=U_{hom}, S= Standard deviation, t= t-value at 95% CI, and n= number of observations.

$$1.\ N_{MIN} = \max\left(10, \sqrt[3]{N_{PROD}}\right) \qquad\qquad 2.\ U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

Certification Laboratories: Much of the analytical work performed to assess this material has been carried out by laboratories with proven competence, as indicated by their accreditation to ISO 17025. It is an implicit requirement for this accreditation that analytical work should be performed with due traceability, via an unbroken chain of comparisons, each with stated uncertainty, to primary standards such as the mole, or to nationally- or internationally-recognised reference materials. Of the individual results herein, some have traceability (to the mole) via primary analytical methods. Some are traceable to substances of known stoichiometry. Most have traceability via commercial solutions. Furthermore, some results have additional traceability to NIST standards, as part of the analytical calibration or process control.

- LGC Standards - Manchester, NH
- Dirats Laboratories - Westfield, MA
- IMR Test Labs - Lansing, NY
- TCR Engineering - Mumbai, India
- NSL Analytical Services - Cleveland, OH
- SGS MSi - Melrose Park, IL
- AnchorCert Analytical - Birmingham, UK
- EAG Laboratories - Liverpool, NY
- Lithea s.r.o. - Brno, Czech Republic
- New Hampshire Materials Laboratory - Somersworth, NH
- Scrooby's Laboratory Services - Benoni, South Africa
- Universal Scientific Laboratory - Revesby, Australia
- IMR Test Labs - Louisville, KY
- Connecticut Metallurgical, Inc. - East Hartford, CT

Instructions for Use: The test surface is on the opposite side of the labeled surface, which includes the material identification. This material is individually chill cast per piece. This manner of casting can cause the formation of inhomogeneous segregates in the upper, engraved portion of the disk. Therefore, the certification information above is not applicable to within 3mm of the engraved surface. Each packaged disk has been prepared by finishing the test surface using a lathe. The user must determine the correct surface preparation procedure for each analytical technique. The user is cautioned to use care when either resurfacing the disk or performing additional polishing, as these processes may contaminate the surface. The minimum sample size for chips should be individually evaluated based on the analytical technique used; this would typically be greater than 0.1 grams. The material should be stored in a cool, dry location when not in use.
Chips are not recommended for gas analysis.

Period of Validity: The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Kimberly Halkiotis, Global Product Manager

March 25, 2022
Certification Date

ISO 17034 Accredited: Reference Materials Producer, Certificate # 2848.02
ISO/IEC 17025 Accredited: Chemical Testing, Certificate # 2848.01

Conditions of Sale and Supply: All CRMs & RMs sold are subject to applicable LGC Standard Terms and Conditions of Sale.

The following data represents all pertinent information reported as it applies to the chemical characterization of this material.

	Ag	Al	As	B	Bi	Cd	Co	Cr	Cu	Fe	Mn	Ni
1	0.0018	0.4260	0.0236	0.0004	0.0540	0.0001	0.0004	0.0001	55.260	0.0100	0.1194	0.2340
2	0.0018	0.4300	0.0240	0.0011	0.0552	0.0001	0.0010	0.0002	55.276	0.0101	0.1200	0.2438
3	0.0020	0.4350	0.0260	0.0015	0.0569	0.0002	<0.001	0.0002	55.350	0.0103	0.1220	0.2440
4	0.0020	0.4540	0.0261	0.0015	0.0574	0.0002		0.0002	55.400	0.0110	0.1220	0.2440
5	0.0022	0.4620	0.0264	0.0017	0.0580	0.0003		0.0003	55.466	0.0117	0.1240	0.2481
6	0.0024	0.4640	0.0269	0.0020	0.0591	0.0003		0.0003	55.493	0.0120	0.1250	0.2500
7	0.0025	0.4670	0.0270	0.0020	0.0601	<0.0001		0.0004	55.500	0.0136	0.1250	0.2506
8	0.0025	0.4715	0.0271	0.0041	0.0610	<0.0005		<0.001	55.540	0.0140	0.1250	0.2510
9	0.0027	0.4774	0.0272	0.0045	0.0610	<0.001		<0.001	55.850	0.0140	0.1267	0.2540
10	0.0030	0.4850	0.0274	<0.005	0.0610	<0.001		<0.0010	55.890	0.0150	0.1267	0.2550
11	0.0030	0.4934	0.0276	<0.01	0.0610	<0.0010		<0.005	55.901	0.0152	0.1270	0.2560
12	0.0030	0.4950	0.0280	<0.01	0.0620	<0.005			56.000	0.0156	0.1270	0.2585
13	0.0030	0.4980	0.0286		0.0650				56.083	0.0160	0.1290	0.2592
14	0.0030	0.5040	0.0287		0.0660					0.0160	0.1300	0.2600
15	<0.0020	0.5058	0.0290		0.0676					0.0172	0.1300	0.2600
16		0.5058	0.0290		0.0690					0.0175	0.1310	0.2600
17		0.5180	0.0310							0.0176	0.1370	0.2620
18		0.5182	0.0310							0.0180	0.1410	0.2620
19		0.5250									0.1480	0.2620
20		0.5300										0.2640
21												0.2730
Mean	0.0025	0.4833	0.0275	0.0021	0.0609	0.0002	0.0007	0.0002	55.616	0.0142	0.1282	0.2548
STDV	0.0005	0.0315	0.0020	0.0013	0.0043	0.0001	0.0004	0.0001	0.2877	0.0027	0.0072	0.0089
Certified	**0.0025**	**0.48**	**0.027**	**(0.002)**	**0.061**	**0.00019**	**(0.0007)**	**0.0002**	**55.6**	**0.014**	**0.128**	**0.255**
U_{CRM}	0.0003	0.01	0.001		0.002	0.00008		0.0001	0.2	0.001	0.003	0.004
Methods	M,O,X,G,A	I,IM,O,X,G	I,IM,O,X	I,IM,G	I,X,G,IM,O	IM,I,G	I,O	IM,I,G	I,X,G,O,W	I,IM,O,X,A	I,IM,X,G,O	I,IM,O,X,G,A

	P	Pb	Sb	Se	Si	Sn	Zn
1	0.0930	0.2510	0.0634	0.0002	0.2200	0.5600	41.673
2	0.1000	0.2560	0.0640	0.0003	0.2248	0.5750	41.816
3	0.1031	0.2570	0.0641	0.0008	0.2260	0.5900	41.832
4	0.1048	0.2590	0.0705	0.0009	0.2267	0.6020	41.890
5	0.1070	0.2620	0.0710	0.0010	0.2290	0.6040	41.947
6	0.1084	0.2627	0.0712	0.0010	0.2290	0.6090	42.000
7	0.1100	0.2650	0.0730	0.0010	0.2315	0.6100	42.030
8	0.1100	0.2650	0.0757	<0.0005	0.2330	0.6124	42.030
9	0.1110	0.2700	0.0771	<0.001	0.2370	0.6158	42.061
10	0.1120	0.2703	0.0775	<0.005	0.2383	0.6179	42.100
11	0.1130	0.2705	0.0780	<0.005	0.2450	0.6180	42.213
12	0.1150	0.2720	0.0804	<0.0050	0.2450	0.6370	42.350
13	0.1190	0.2731	0.0820		0.2460	0.6380	42.490
14	0.1205	0.2800	0.0830		0.2560	0.6410	42.778
15	0.1300	0.2800	0.0840			0.6450	43.090
16	0.1340	0.2840	0.0850			0.6460	43.300
17	0.1460	0.2856				0.6500	
18	0.1540	0.2950				0.6500	
19		0.3090				0.6510	
20						0.6700	
21							
Mean	0.1162	0.2720	0.0750	0.0007	0.2348	0.6221	42.225
STDV	0.0158	0.0144	0.0072	0.0004	0.0102	0.0280	0.4677
Certified	**0.116**	**0.272**	**0.075**	**(0.0007)**	**0.235**	**0.62**	**42.2**
U_{CRM}	0.008	0.007	0.004		0.006	0.01	0.2
Methods	I,IM,O,X,G,W	I,IM,O,X,G,A	I,IM,O,X	IM,O,I,G	I,IM,X,G,W	I,O,X,G,IM	I,X,G,O,W

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, IM=ICP-MS, D = DC Arc, O = AES, X = XRF, G = GDAES or GDMS, H = Hollow Cathode AES

LGC