

Certified Reference Material

Certificate of Analysis

Product ID: MBH-31X BIB1 E

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Revision No.: 000
Revision Date: 03/09/2022

Product Description: Bismuth Brass Alloy

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 0.0014 ± 0.0003	Al 0.213 ± 0.003	As 0.0290 ± 0.0009	Bi 1.96 ± 0.04
Cd 0.0091 ± 0.0003	Co 0.0057 ± 0.0003	Cr 0.0006 ± 0.0004	Cu 62.7 ± 0.1
Fe 0.074 ± 0.001	Mn 0.0266 ± 0.0007	Ni 0.301 ± 0.004	P 0.062 ± 0.002
Pb 0.090 ± 0.004	Sb 0.012 ± 0.001	Si 0.065 ± 0.002	Sn 0.376 ± 0.008
Zn 34.0 ± 0.1			

Indicative Values listed in ppm

B (<10) S (30) Se (10)

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 calculate 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.

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

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
- Laboratory Testing, Inc. - Hatfield, PA
- NSL Analytical Services - Cleveland, OH
- SGS MSi - Melrose Park, IL
- AnchorCert Analytical - Birmingham, UK
- Applied Technical Services - Marietta, GA
- EAG Laboratories - Liverpool, NY
- Lithea s.r.o. - Brno-Sadová, Czech Republic
- New Hampshire Materials Laboratory - Somersworth, NH
- TEC Eurolab - Campogalliano, Italy
- Scrooby's Laboratory Services - Benoni, South Africa
- Universal Scientific Laboratory - Revesby, Australia

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 9, 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	P
1	0.0005	0.2000	0.0254	0.0007	1.8470	0.0080	0.0048	0.0002	62.360	0.0700	0.0243	0.2890	0.0519
2	0.0010	0.2060	0.0260	0.0008	1.8480	0.0082	0.0049	0.0001	62.386	0.0712	0.0245	0.2900	0.0560
3	0.0010	0.2070	0.0265	0.0014	1.8570	0.0083	0.0049	0.0001	62.430	0.0713	0.0250	0.2901	0.0577
4	0.0010	0.2080	0.0275		1.8570	0.0087	0.0050	0.0002	62.484	0.0717	0.0252	0.2940	0.0577
5	0.0012	0.2090	0.0279		1.8900	0.0089	0.0050	0.0003	62.535	0.0719	0.0256	0.2970	0.0590
6	0.0014	0.2098	0.0280		1.9070	0.0090	0.0052	0.0007	62.549	0.0725	0.0260	0.2970	0.0598
7	0.0014	0.2102	0.0285		1.9100	0.0090	0.0052	0.0007	62.600	0.0730	0.0260	0.2973	0.0600
8	0.0018	0.2110	0.0290		1.9130	0.0091	0.0055	0.0013	62.660	0.0730	0.0260	0.2994	0.0605
9	0.0019	0.2114	0.0290		1.9430	0.0091	0.0057	0.0014	62.720	0.0740	0.0261	0.3020	0.0608
10	0.0020	0.2140	0.0292		1.9693	0.0093	0.0058	<0.00005	62.770	0.0749	0.0261	0.3023	0.0613
11	0.0020	0.2140	0.0299		1.9700	0.0093	0.0060	<0.0001	62.880	0.0750	0.0264	0.3030	0.0625
12	0.0022	0.2140	0.0300		1.9966	0.0094	0.0060	<0.001	62.890	0.0760	0.0269	0.3050	0.0640
13	<0.005	0.2142	0.0300		2.0110	0.0097	0.0060	<0.0010	63.086	0.0761	0.0273	0.3050	0.0648
14		0.2173	0.0306		2.0119	0.0098	0.0060	<0.002	63.154	0.0765	0.0280	0.3067	0.0650
15		0.2180	0.0307		2.0156	0.0100	0.0061	<0.002		0.0780	0.0280	0.3094	0.0670
16		0.2190	0.0310		2.0178	0.0100	0.0062	<0.002		0.0782	0.0289	0.3099	0.0670
17		0.2190	0.0310		2.0190	<0.005	0.0068	<0.005		0.0800	0.0290	0.3120	0.0685
18		0.2194	0.0322		2.0390	<0.01	0.0070				0.0290	0.3150	0.0690
19		0.2210			2.0400		0.0071						0.0710
20		0.2270			2.1600								
Mean	0.0014	0.2135	0.0290	0.0010	1.9611	0.0091	0.0057	0.0006	62.679	0.0743	0.0266	0.3013	0.0623
STDV	0.0005	0.0062	0.0019	0.0004	0.0823	0.0006	0.0007	0.0005	0.2509	0.0028	0.0015	0.0077	0.0049
Certified	0.0014	0.213	0.0290	(<0.001)	1.96	0.0091	0.0057	0.0006	62.7	0.074	0.0266	0.301	0.062
U _{CRM}	0.0003	0.003	0.0009		0.04	0.0003	0.0003	0.0004	0.1	0.001	0.0007	0.004	0.002
Methods	IM,X,I,O,G	I,O,X,IM,G	I,X,IM,O	I	I,O,X,G	I,X,IM,O,G	IM,I,O,X,G	IM,I,O,X,G	I,O,X,W,G	I,O,X,IM,G	I,IM,O,X,G	I,O,IM,X,G	I,O,X,IM,W,G

	Pb	S	Sb	Se	Si	Sn	Zn
1	0.0806	0.0001	0.0090	0.0001	0.0570	0.3490	33.631
2	0.0816	0.0006	0.0090	0.0002	0.0590	0.3510	33.641
3	0.0822	0.0010	0.0100	0.0003	0.0600	0.3540	33.657
4	0.0840	0.0011	0.0100	0.0010	0.0624	0.3600	33.700
5	0.0850	0.0011	0.0112	0.0010	0.0630	0.3670	33.800
6	0.0861	0.0014	0.0115	0.0013	0.0630	0.3671	33.845
7	0.0870	0.0020	0.0120	0.0015	0.0630	0.3750	33.991
8	0.0880	0.0021	0.0120	0.0016	0.0630	0.3759	34.000
9	0.0890	0.0025	0.0126	0.0031	0.0634	0.3759	34.036
10	0.0891	0.0030	0.0126	<0.0005	0.0641	0.3790	34.050
11	0.0921	0.0045	0.0128	<0.005	0.0645	0.3810	34.100
12	0.0925	0.0054	0.0130	<0.0050	0.0648	0.3820	34.120
13	0.0960	0.0110	0.0134	<0.01	0.0652	0.3822	34.184
14	0.0960	<0.0001	0.0139	<0.01	0.0667	0.3883	34.240
15	0.1010	<0.0005	0.0140	<0.05	0.0670	0.3910	34.246
16	0.1025	<0.005	0.0140		0.0675	0.3940	34.250
17	0.1030	<0.005	0.0153		0.0700	0.3990	34.304
18		<0.005	0.0160		0.0710	0.3993	34.420
19					0.0713		34.440
20							
Mean	0.0903	0.0028	0.0124	0.0011	0.0645	0.3762	34.034
STDV	0.0072	0.0029	0.0020	0.0009	0.0038	0.0156	0.2603
Certified	0.09	(0.003)	0.012	(0.001)	0.065	0.376	34.0
U _{CRM}	0.004		0.001		0.002	0.008	0.1
Methods	I,O,IM,X,G	C,O,X,I,G	IM,I,O,X,G	IM,I,O,X,G	I,O,X,IM,W,G	I,X,IM,O,G	I,O,X,W,G

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

