

Certified Reference Material **Certificate of Analysis**

Product ID: MBH-31X B22 G



Product Description: Major Elements 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	0.0015	± 0.0002	Al	0.100	± 0.003	As	0.150	± 0.004	B	0.0029	± 0.0004
Bi	0.148	± 0.004	Cd	0.0130	± 0.0009	Co	0.059	± 0.003	Cr	0.0006	± 0.0003
Cu	80.5	± 0.1	Fe	0.107	± 0.002	Mn	0.00076	± 0.00009	Ni	0.142	± 0.003
P	0.214	± 0.006	Pb	0.197	± 0.005	Sb	0.147	± 0.003	Se	0.0007	± 0.0004
Si	0.152	± 0.004	Sn	0.225	± 0.005	Zn	17.8	± 0.2			

Indicative Values listed in ppm
S (50)

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-recognized 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
- TEC Eurolab - Campogalliano, Italy
- AnchorCert Analytical - Birmingham, UK
- Dirats Laboratories - Westfield, MA
- IMR Test Labs - Lansing, NY
- TCR Engineering Services - Maharashtra, India
- Laboratory Testing, Inc. - Hatfield, PA
- SGS MSI - Melrose Park, IL
- Institute of Non-Ferrous Metals - Gliwice, Poland
- Universal Scientific Laboratory - Revesby, Australia
- Scrooby's Laboratory Service - Rynfield, South Africa
- Applied Technical Services - Marietta, GA

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 Halkotis, Global Product Manager

November 5, 2021
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	0.0008	0.0910	0.1386	0.0019	0.1354	0.0100	0.0520	0.0003	80.205	0.1010	0.0006	0.1314	0.1990
2	0.0010	0.0916	0.1417	0.0020	0.1366	0.0110	0.0542	0.0003	80.300	0.1014	0.0007	0.1377	0.2000
3	0.0013	0.0930	0.1421	0.0025	0.1400	0.0110	0.0550	0.0003	80.400	0.1023	0.0007	0.1380	0.2010
4	0.0014	0.0939	0.1450	0.0030	0.1443	0.0122	0.0550	0.0004	80.432	0.1037	0.0007	0.1400	0.2016
5	0.0015	0.0970	0.1450	0.0030	0.1459	0.0125	0.0550	0.0009	80.470	0.1050	0.0008	0.1407	0.2037
6	0.0016	0.0982	0.1459	0.0031	0.1460	0.0130	0.0580	0.0010	80.491	0.1070	0.0008	0.1410	0.2070
7	0.0016	0.0990	0.1480	0.0032	0.1462	0.0131	0.0591	0.0010	80.550	0.1070	0.0009	0.1410	0.2100
8	0.0017	0.1000	0.1480	0.0032	0.1480	0.0133	0.0592	<0.0001	80.626	0.1080	0.0009	0.1420	0.2110
9	0.0017	0.1008	0.1480	0.0033	0.1480	0.0134	0.0592	<0.0005	80.720	0.1083	<0.001	0.1431	0.2130
10	0.0017	0.1013	0.1523	0.0034	0.1480	0.0139	0.0600	<0.001	80.780	0.1095	<0.002	0.1440	0.2140
11	0.0020	0.1020	0.1540	0.0037	0.1500	0.0140	0.0611	<0.0010		0.1098	<0.002	0.1440	0.2140
12	<0.002	0.1020	0.1542	<0.005	0.1520	0.0143	0.0612	<0.002		0.1100	<0.002	0.1450	0.2200
13	<0.005	0.1024	0.1570		0.1523	0.0150	0.0642	<0.002		0.1109	<0.005	0.1480	0.2201
14		0.1030	0.1600		0.1550	0.0151	0.0648	<0.005		0.1140	<0.005	0.1480	0.2280
15		0.1050	0.1640		0.1550	<0.005	0.0690			0.1140			0.2297
16		0.1060			0.1610								0.2300
17		0.1110											0.2300
Mean	0.0015	0.0998	0.1496	0.0029	0.1477	0.0130	0.0591	0.0006	80.497	0.1075	0.0008	0.1417	0.2137
STDV	0.0003	0.0053	0.0072	0.0006	0.0067	0.0015	0.0046	0.0003	0.1789	0.0041	0.0001	0.0043	0.0110
Certified	0.0015	0.100	0.150	0.0029	0.148	0.0130	0.059	0.0006	80.5	0.107	0.00076	0.142	0.214
U _{CRM}	0.0002	0.003	0.004	0.0004	0.004	0.0009	0.003	0.0003	0.1	0.002	0.00009	0.003	0.006
Methods	O,I,X,A,IM	O,I,X	O,I,X	O,I	O,I,X	O,I,X,A	O,I,X,A	O,I,X,A,IM	O,W,X,I	O,I,X,A	O,I,X,A,IM	O,I,X,A	O,I,X,W

	Pb	S	Sb	Se	Si	Sn	Zn
1	0.1790	0.0005	0.1400	0.0001	0.1440	0.2090	17.303
2	0.1815	0.0005	0.1400	0.0003	0.1442	0.2090	17.590
3	0.1860	0.0020	0.1416	0.0003	0.1460	0.2110	17.600
4	0.1910	0.0021	0.1430	0.0007	0.1470	0.2217	17.645
5	0.1950	0.0022	0.1460	0.0010	0.1470	0.2240	17.720
6	0.1960	0.0024	0.1460	0.0010	0.1473	0.2250	17.730
7	0.1960	0.0065	0.1471	0.0013	0.1482	0.2257	17.740
8	0.1984	0.0070	0.1472	<0.0005	0.1490	0.2270	17.750
9	0.2023	0.0100	0.1490	<0.001	0.1500	0.2290	17.837
10	0.2030	0.0120	0.1500	<0.002	0.1520	0.2290	17.934
11	0.2030	<0.0001	0.1510	<0.005	0.1534	0.2300	18.000
12	0.2040	<0.001	0.1510		0.1540	0.2302	18.180
13	0.2044	<0.005	0.1520		0.1560	0.2340	18.500
14	0.2046		0.1540		0.1600	0.2350	
15	0.2070		0.1541		0.1610	0.2366	
16					0.1651		
17							
Mean	0.1967	0.0045	0.1475	0.0007	0.1515	0.2251	17.810
STDV	0.0088	0.0041	0.0047	0.0004	0.0063	0.0090	0.2979
Certified	0.197	(0.005)	0.147	0.0007	0.152	0.225	17.8
U _{CRM}	0.005		0.003	0.0004	0.004	0.005	0.2
Methods	O,I,X,A	O,C,I,X	O,I,X,A	O,I,X	O,I,X,W	O,I,X	O,I,X,A,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

