

Certified Reference Material **Certificate of Analysis**

Product ID: MBH-31X TB1 L

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Copper Alloy, Phosphor-Copper

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	0.061	± 0.002	Al	0.174	± 0.003	As	0.052	± 0.002	B	0.0005	± 0.0002
Bi	0.049	± 0.001	Cd	0.0122	± 0.0005	Co	0.0017	± 0.0003	Cr	0.0024	± 0.0003
Cu	61.5	± 0.2	Fe	0.072	± 0.002	Mn	0.287	± 0.004	Ni	0.199	± 0.005
P	0.0080	± 0.0007	Pb	0.325	± 0.009	Sb	0.101	± 0.004	Se	0.0008	± 0.0004
Si	0.097	± 0.003	Sn	0.214	± 0.004	Zn	36.8	± 0.2			

Indicative Values listed in ppm
S (20) Te (40) Zr (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.

$$1. N_{MIN} = \max(10, \sqrt[3]{N_{PROD}})$$

$$2. U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

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

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	0.0560	0.1647	0.0460	0.0002	0.0457	0.0109	0.0008	0.0019	60.930	0.0630	0.2740	0.1780	0.0052
2	0.0564	0.1670	0.0480	0.0003	0.0458	0.0110	0.0010	0.0020	61.174	0.0660	0.2780	0.1870	0.0063
3	0.0568	0.1680	0.0480	0.0004	0.0465	0.0110	0.0012	0.0020	61.180	0.0680	0.2780	0.1920	0.0070
4	0.0580	0.1700	0.0486	0.0004	0.0476	0.0110	0.0013	0.0020	61.350	0.0694	0.2780	0.1928	0.0070
5	0.0580	0.1700	0.0500	0.0005	0.0483	0.0120	0.0013	0.0021	61.460	0.0697	0.2817	0.1930	0.0070
6	0.0588	0.1703	0.0500	0.0005	0.0490	0.0120	0.0018	0.0022	61.500	0.0698	0.2833	0.1933	0.0071
7	0.0603	0.1710	0.0506	0.0006	0.0492	0.0120	0.0018	0.0022	61.500	0.0698	0.2840	0.1950	0.0074
8	0.0605	0.1710	0.0516	0.0010	0.0496	0.0121	0.0019	0.0023	61.557	0.0699	0.2849	0.1950	0.0075
9	0.0608	0.1727	0.0520	0.0010	0.0500	0.0121	0.0019	0.0023	61.570	0.0700	0.2860	0.1970	0.0075
10	0.0610	0.1730	0.0520	<0.0005	0.0500	0.0123	0.0019	0.0026	61.747	0.0707	0.2870	0.1990	0.0079
11	0.0620	0.1755	0.0522	<0.001	0.0500	0.0123	0.0020	0.0026	61.900	0.0715	0.2892	0.1992	0.0087
12	0.0620	0.1774	0.0527	<0.0010	0.0500	0.0127	0.0020	0.0030	62.024	0.0720	0.2896	0.1997	0.0090
13	0.0639	0.1800	0.0528	<0.0010	0.0503	0.0128	0.0020	0.0032	62.177	0.0722	0.2910	0.2000	0.0090
14	0.0644	0.1800	0.0533	<0.005	0.0510	0.0130	0.0020	0.0036		0.0730	0.2913	0.2001	0.0096
15	0.0663	0.1828	0.0534		0.0513	0.0138	0.0021	<0.0010		0.0731	0.2950	0.2020	0.0097
16	0.0670	0.1830	0.0534		0.0520	0.0140	0.0028	<0.0010		0.0735	0.3000	0.2073	0.0100
17		0.1850	0.0540		0.0543	<0.005	<0.002	<0.002		0.0740	0.3000	0.2100	0.0102
18			0.0599		<0.0010		<0.002	<0.002		0.0760	0.3010	0.2190	
19			0.0600				<0.005	<0.005		0.0790		0.2250	
20			0.0610							0.0810			
21													
Mean	0.0608	0.1742	0.0525	0.0005	0.0494	0.0122	0.0017	0.0024	61.544	0.0716	0.2873	0.1992	0.0080
STDV	0.0034	0.0061	0.0040	0.0003	0.0022	0.0009	0.0005	0.0005	0.3528	0.0041	0.0081	0.0107	0.0014
Certified	0.061	0.174	0.052	0.0005	0.049	0.0122	0.0017	0.0024	61.5	0.072	0.287	0.199	0.0080
U _{CRM}	0.002	0.003	0.002	0.0002	0.001	0.0005	0.0003	0.0003	0.2	0.002	0.004	0.005	0.0007
Methods	O,I,IM,X,A	O,I,X,IM	O,I,IM,X	O,IM,I	O,I,X,IM	O,I,IM,X,A	O,I,IM,X,A	O,I,IM,X	O,W,I,X	O,I,IM,X,A	O,I,X,IM,A	O,I,X,IM,A	O,I,IM,X,W

	Pb	S	Sb	Se	Si	Sn	Te	Zn	Zr
1	0.2810	0.0003	0.0860	0.0001	0.0880	0.1970	0.0001	36.207	0.0001
2	0.2940	0.0009	0.0901	0.0004	0.0894	0.2030	0.0003	36.350	0.0001
3	0.3007	0.0015	0.0910	0.0007	0.0914	0.2030	0.0005	36.372	0.0001
4	0.3010	0.0017	0.0923	0.0009	0.0920	0.2036	0.0025	36.460	0.0010
5	0.3080	0.0018	0.0949	0.0010	0.0927	0.2070	0.0028	36.500	0.0010
6	0.3110	0.0023	0.0958	0.0010	0.0940	0.2073	0.0028	36.538	0.0017
7	0.3140	0.0038	0.0970	0.0014	0.0942	0.2120	0.0031	36.619	0.0018
8	0.3190	<0.0001	0.0983	<0.0005	0.0950	0.2123	0.0040	36.740	0.0019
9	0.3210	<0.0001	0.0998	<0.0005	0.0988	0.2136	0.0100	36.750	<0.00005
10	0.3310	<0.0005	0.1003	<0.001	0.0993	0.2150	0.0110	36.780	<0.0001
11	0.3320	<0.0005	0.1003	<0.002	0.0997	0.2176	<0.0005	36.873	<0.0005
12	0.3340	<0.001	0.1005	<0.005	0.1000	0.2200	<0.0005	36.910	<0.0005
13	0.3380	<0.0010	0.1012	<0.005	0.1000	0.2200	<0.001	36.939	<0.001
14	0.3389	<0.002	0.1040	<0.0050	0.1000	0.2200	<0.0010	36.970	<0.0010
15	0.3409	<0.002	0.1050		0.1009	0.2210	<0.002	37.210	<0.005
16	0.3410	<0.002	0.1070		0.1030	0.2230	<0.002	37.330	
17	0.3410	<0.003	0.1100		0.1040	0.2232	<0.005	37.620	
18	0.3413		0.1100		0.1100	0.2240			
19	0.3435		0.1200			0.2300			
20	0.3460		0.1200						
21	0.3500								
Mean	0.3251	0.0018	0.1012	0.0008	0.0974	0.2144	0.0037	36.775	0.0010
STDV	0.0196	0.0011	0.0090	0.0004	0.0057	0.0089	0.0038	0.3731	0.0008
Certified	0.325	(0.002)	0.101	0.0008	0.097	0.214	(0.004)	36.8	(0.001)
U _{CRM}	0.009		0.004	0.0004	0.003	0.004		0.2	
Methods	O,I,IM,X,A	O,C,I,X	O,I,IM,X,A	O,IM,I,X	O,I,IM,X,W	O,I,IM,X,A	O,I,IM,X,A	O,I,X,A,W	O,I,IM,X,A

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

