

Certified Reference Material **Certificate of Analysis**

Product ID: MBH-32X PB15 B

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Copper Alloy, Phosphor-Bronze

Revision No.: 001
Revision Date: 03/30/2022

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

Al 0.064 ± 0.002	As 0.102 ± 0.003	Bi 0.0002 ± 0.0001	Co 0.037 ± 0.001
Cr 0.0004 ± 0.0002	Fe 0.044 ± 0.002	Mg 0.023 ± 0.001	Mn 0.0006 ± 0.0002
Ni 0.145 ± 0.003	P 0.104 ± 0.005	Pb 0.046 ± 0.002	S 0.0016 ± 0.0003
Sb 0.020 ± 0.001	Se 0.0008 ± 0.0005	Sn 2.04 ± 0.04	Zn 0.75 ± 0.01

Indicative Values listed in ppm

Ag (<10)	Cd (10)	Cu (96.6%)	Nb (40)
O (<20)	Si (50)	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.

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

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
- Dirats Laboratories - Westfield, MA
- NSL Analytical Services - Cleveland, OH
- Laboratory Testing, Inc. - Hatfield, PA
- Applied Technical Services - Marietta, GA
- 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

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 Conditions of Sale.



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

	Ag	Al	As	Bi	Cd	Co	Cr	Cu	Fe	Mg	Mn	Nb	Ni
1	0.0008	0.0604	0.0930	0.0001	0.00001	0.0330	0.0001	95.880	0.0360	0.0190	0.0006	0.0006	0.1362
2	0.0010	0.0610	0.0972	0.0001	0.00003	0.0336	0.0001	96.175	0.0370	0.0205	0.0002	0.0020	0.1400
3	0.0011	0.0610	0.0980	0.0001	0.0001	0.0340	0.0003	96.267	0.0390	0.0210	0.0004	0.0060	0.1400
4		0.0620	0.0990	0.0001	0.0003	0.0342	0.0004	96.370	0.0407	0.0220	0.0004	0.0090	0.1406
5		0.0630	0.0995	0.0003	0.0009	0.0350	0.0006	96.500	0.0420	0.0223	0.0007	<0.00005	0.1410
6		0.0630	0.1005	0.0003	0.0020	0.0352	0.0006	96.578	0.0428	0.0225	0.0007	<0.0001	0.1440
7		0.0630	0.1010	<0.0005	<0.00005	0.0360	<0.00005	96.650	0.0430	0.0227	0.0007	<0.0001	0.1450
8		0.0632	0.1015	<0.001	<0.0001	0.0366	<0.0005	96.663	0.0430	0.0230	0.0008	<0.0005	0.1460
9		0.0632	0.1025	<0.001	<0.0001	0.0371	<0.0005	96.670	0.0438	0.0234	0.0008	<0.001	0.1460
10		0.0640	0.1030	<0.001	<0.0005	0.0372	<0.001	96.710	0.0440	0.0237	0.0008	<0.001	0.1480
11		0.0642	0.1030	<0.002	<0.001	0.0380	<0.001	96.800	0.0455	0.0240	<0.0001	<0.002	0.1488
12		0.0648	0.1048	<0.002	<0.002	0.0385	<0.001	97.250	0.0457	0.0242	<0.0005	<0.005	0.1500
13		0.0650	0.1050	<0.002	<0.002	0.0385	<0.002	97.350	0.0459	0.0249	<0.001		0.1510
14		0.0653	0.1100	<0.005	<0.002	0.0390	<0.005		0.0462	0.0250	<0.002		0.1512
15		0.0670	0.1120		<0.005	0.0390			0.0472	0.0259	<0.002		0.1517
16		0.0681				0.0400			0.0475	0.0276	<0.002		
17		0.0703							0.0496	0.0276	<0.005		
18									0.0500				
19													
20													
Mean	0.0010	0.0640	0.1020	0.0002	0.0006	0.0366	0.0004	96.605	0.0438	0.0235	0.0006	0.0044	0.1453
STDV	0.0002	0.0026	0.0048	0.0001	0.0008	0.0022	0.0002	0.4001	0.0039	0.0023	0.0002	0.0038	0.0049
Certified	<0.001	0.064	0.102	0.0002	(0.001)	0.037	0.0004	(96.6)	0.044	0.023	0.0006	(0.004)	0.145
U _{CRM}		0.002	0.003	0.0001		0.001	0.0002		0.002	0.001	0.0002		0.003
Methods	IM,O,I	O,I,IM,X	O,I,IM,X	IM,I,O,X	IM,I,O,X	O,I,IM,X	O,IM,I,X	O,I,W,X	O,I,IM,X	O,I,IM,X	IM,I,O,X	O,IM,I,X	O,IM,I,X

	O	P	Pb	S	Sb	Se	Si	Sn	Zn	Zr
1	0.0010	0.0892	0.0410	0.0009	0.0150	0.0001	0.0021	1.8900	0.7080	0.0001
2	0.0020	0.0930	0.0421	0.0011	0.0177	0.0003	0.0032	1.9540	0.7120	0.0001
3		0.0960	0.0430	0.0014	0.0180	0.0007	0.0038	1.9700	0.7200	0.0018
4		0.0960	0.0430	0.0015	0.0185	0.0011	0.0040	1.9810	0.7293	0.0020
5		0.0989	0.0446	0.0015	0.0190	0.0011	0.0041	1.9970	0.7350	0.0020
6		0.0998	0.0454	0.0016	0.0192	0.0014	0.0044	2.0150	0.7350	<0.00005
7		0.1004	0.0455	0.0017	0.0200	<0.0005	0.0050	2.0151	0.7357	<0.0001
8		0.1020	0.0456	0.0018	0.0203	<0.0005	0.0050	2.0200	0.7370	<0.0005
9		0.1020	0.0460	0.0025	0.0209	<0.001	0.0054	2.0210	0.7430	<0.0005
10		0.1050	0.0465	<0.0001	0.0215	<0.001	0.0059	2.0430	0.7470	<0.001
11		0.1050	0.0470	<0.003	0.0218	<0.002	0.0060	2.0487	0.7495	<0.001
12		0.1085	0.0470		0.0220	<0.005	0.0064	2.0557	0.7522	<0.001
13		0.1100	0.0471		0.0221	<0.005	0.0080	2.0608	0.7530	<0.002
14		0.1110	0.0474		0.0222		0.0120	2.0710	0.7550	<0.002
15		0.1135	0.0480		0.0227		<0.0005	2.0800	0.7650	<0.002
16		0.1150	0.0499		0.0260		<0.005	2.1070	0.7800	<0.005
17		0.1170	0.0521					2.1400	0.7893	
18		0.1176						2.1850	0.7900	
19									0.7960	
20									0.7990	
Mean	0.0015	0.1044	0.0460	0.0016	0.0204	0.0008	0.0054	2.0363	0.7516	0.0012
STDV	0.0007	0.0084	0.0028	0.0005	0.0026	0.0005	0.0024	0.0689	0.0273	0.0010
Certified	<0.002	0.104	0.046	0.0016	0.020	0.0008	(0.005)	2.04	0.75	(0.001)
U _{CRM}		0.005	0.002	0.0003	0.001	0.0005		0.04	0.01	
Methods	F	O,I,IM,X,W	O,I,IM,X	C,O,I	O,I,IM,X	O,IM,I,X	O,I,IM,X,W	O,I,X,W	O,I,IM,X	O,I,IM,X

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

