

Certified Reference Material

Certificate of Analysis

Product ID: MBH-31X MNB12 C

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

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

Product Description: Manganese 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 0.0021 ± 0.0004	Al 0.70 ± 0.02	As 0.0100 ± 0.0006	Bi 0.0101 ± 0.0009
C 0.009 ± 0.001	Cd 0.0022 ± 0.0001	Co 0.012 ± 0.002	Cr 0.0026 ± 0.0006
Cu 58.3 ± 0.3	Fe 0.29 ± 0.01	Mn 16.1 ± 0.2	Ni 0.696 ± 0.009
P 0.078 ± 0.003	Pb 1.97 ± 0.03	Sb 0.0101 ± 0.0009	Si 0.046 ± 0.002
Sn 0.171 ± 0.005	Zn 21.2 ± 0.3		

Indicative Values listed in ppm

B (13)	Mg (100)	S (100)	Se (70)
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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
- 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 Hakiotis, 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	C	Cd	Co	Cr	Cu	Fe	Mg
1	0.0006	0.6000	0.0080	0.0010	0.0070	0.0063	0.0019	0.0070	0.0010	57.680	0.2570	0.00001
2	0.0010	0.6566	0.0082	0.0012	0.0088	0.0069	0.0020	0.0070	0.0016	57.760	0.2640	0.0006
3	0.0010	0.6700	0.0087	0.0017	0.0089	0.0075	0.0020	0.0073	0.0020	57.845	0.2720	0.0290
4	0.0018	0.6807	0.0090		0.0090	0.0079	0.0020	0.0080	0.0026	57.920	0.2798	0.0302
5	0.0020	0.6840	0.0096		0.0093	0.0090	0.0020	0.0090	0.0029	57.990	0.2810	<0.00005
6	0.0022	0.6950	0.0099		0.0096	0.0091	0.0022	0.0100	0.0030	58.000	0.2810	<0.0001
7	0.0023	0.6950	0.0100		0.0098	0.0094	0.0022	0.0100	0.0030	58.010	0.2820	<0.0005
8	0.0024	0.6995	0.0100		0.0100	0.0110	0.0022	0.0121	0.0030	58.197	0.2830	<0.001
9	0.0024	0.7000	0.0100		0.0100	0.0120	0.0023	0.0123	0.0032	58.385	0.2840	<0.001
10	0.0024	0.7010	0.0100		0.0100		0.0024	0.0127	0.0040	58.400	0.2880	<0.0010
11	0.0025	0.7035	0.0103		0.0100		0.0024	0.0128	<0.002	58.550	0.2920	<0.005
12	0.0027	0.7040	0.0103		0.0115		0.0024	0.0130	<0.002	59.050	0.2998	
13	0.0028	0.7060	0.0103		0.0117		0.0024	0.0130	<0.0020	59.470	0.3000	
14	0.0030	0.7170	0.0110		0.0123		<0.002	0.0130	<0.005		0.3050	
15	0.0030	0.7200	0.0110		0.0132		<0.005	0.0140			0.3120	
16	<0.002	0.7217	0.0110				<0.01	0.0140			0.3194	
17	<0.005	0.7270	0.0115					0.0167			0.3290	
18		0.7710	0.0121					0.0170			0.3350	
19								0.0191				
Mean	0.0021	0.6973	0.0100	0.0013	0.0101	0.0088	0.0022	0.0120	0.0026	58.251	0.2924	0.0150
STDV	0.0007	0.0346	0.0011	0.0004	0.0016	0.0019	0.0002	0.0035	0.0009	0.5234	0.0213	0.0169
Certified	0.0021	0.70	0.0100	(0.0013)	0.0101	0.009	0.0022	0.012	0.0026	58.3	0.29	(0.01)
U _{CRM}	0.0004	0.02	0.0006		0.0009	0.001	0.0001	0.002	0.0006	0.3	0.01	
Methods	I,IM,O,G,X,A	I,G,O,X	I,IM,O,X	I,IM	I,IM,O,X	C,G	I,IM,G,X,O,A	I,IM,O,G,X,A	I,IM,X	I,G,O,X,W	I,O,G,IM,X	I,IM,O,G

	Mn	Ni	P	Pb	S	Sb	Se	Si	Sn	Zn
1	15.350	0.6590	0.0692	1.8590	0.0001	0.0080	0.0018	0.0420	0.1520	19.890
2	15.660	0.6760	0.0740	1.8700	0.0009	0.0080	0.0020	0.0430	0.1590	20.156
3	15.870	0.6820	0.0750	1.9030	0.0024	0.0098	0.0028	0.0430	0.1600	20.445
4	15.909	0.6898	0.0750	1.9100	0.0028	0.0100	0.0043	0.0440	0.1670	20.760
5	15.950	0.6900	0.0750	1.9100	0.0030	0.0105	0.0050	0.0443	0.1670	20.850
6	15.965	0.6930	0.0752	1.9309	0.0040	0.0105	0.0051	0.0450	0.1690	20.870
7	16.018	0.6950	0.0757	1.9421	0.0290	0.0110	0.0070	0.0452	0.1700	21.044
8	16.040	0.6963	0.0760	1.9450	0.0332	0.0110	0.0108	0.0456	0.1713	21.303
9	16.180	0.6970	0.0767	1.9500	0.0511	0.0111	0.0120	0.0460	0.1716	21.450
10	16.201	0.6970	0.0780	1.9600	<0.0005	0.0116	0.0125	0.0470	0.1720	21.478
11	16.227	0.6980	0.0790	1.9700	<0.001	<0.001	0.0130	0.0470	0.1720	21.509
12	16.260	0.7009	0.0800	1.9850	<0.001	<0.01	<0.005	0.0474	0.1730	21.540
13	16.358	0.7029	0.0835	1.9930	<0.001		<0.0050	0.0501	0.1730	21.560
14	16.505	0.7170	0.0839	2.0010	<0.002		<0.01	0.0510	0.1740	21.720
15	16.570	0.7220	0.0930	2.0300			<0.01	0.0512	0.1741	21.840
16	16.670	0.7240		2.0400				<0.005	0.1770	21.880
17	16.730			2.0500				<0.005	0.1780	21.990
18				2.0650				<0.005	0.1960	22.020
19				2.0770						
Mean	16.145	0.6962	0.0779	1.9679	0.0141	0.0101	0.0069	0.0461	0.1709	21.239
STDV	0.3618	0.0164	0.0056	0.0643	0.0188	0.0012	0.0044	0.0029	0.0091	0.6291
Certified	16.1	0.696	0.078	1.97	(0.01)	0.0101	(0.007)	0.046	0.171	21.2
U _{CRM}	0.2	0.009	0.003	0.03		0.0009		0.002	0.005	0.3
Methods	I,G,O,X,A,W	I,G,O,A	I,IM,O,X,W	I,O,G,X	I,C,G,X,O	I,IM,O,G,X	I,IM,O,G,X	I,IM,O,G,X,W	I,G,IM,O,X	I,G,O,X,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

