

Certified Reference Material

Certificate of Analysis

Product ID: MBH-71X SR2 G

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Tin with Impurities

Revision No.: 000
Revision Date: 04/06/2022

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

Ag 0.033 ± 0.003	Al 0.005 ± 0.001	As 0.005 ± 0.001	Au 0.005 ± 0.002
Bi 0.041 ± 0.001	Cd 0.034 ± 0.002	Co 0.0017 ± 0.0004	Cu 0.062 ± 0.002
Fe 0.011 ± 0.002	Ga 0.019 ± 0.001	Ge 0.021 ± 0.005	Hg 0.046 ± 0.008
In 0.048 ± 0.002	Ni 0.0127 ± 0.0005	Pb 0.147 ± 0.005	Sb 0.069 ± 0.006
Se 0.002 ± 0.002	Te 0.020 ± 0.004	Zn 0.0045 ± 0.0004	

Indicative Values listed in ppm

Ca (40)	Cr (10)	Mg (2)	Mo (10)	P (40)	S (20)	Sn (99.5%)
Tl (0.3)						

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
- Applied Technical Services - Marietta, GA
- EAG Laboratories - Liverpool, NY
- NSL Analytical Services - Cleveland, OH
- Dirats Laboratories - Westfield, MA
- Sheffield Analytical Services - Sheffield, UK
- SGS MSI - Melrose Park, IL
- IMR Test Labs - Lansing, NY
- Instytut Metalurgii Żelaza - Gliwice, Poland
- Scrooby's Laboratory Services - Benoni, South Africa
- Connecticut Metallurgical, Inc. - East Hartford, CT
- Inppamet Ltda. - Calama, Chile
- Universal Scientific Laboratory - Revesby, Australia
- Northern Analytical Laboratory, Inc. - Londonderry, NH

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

April 06, 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	Au	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Ge
1	0.0260	0.0025	0.0010	0.0010	0.0370	0.0040	0.0250	0.0012	0.00001	0.0570	0.0050	0.0151	0.0108
2	0.0291	0.0030	0.0025	0.0025	0.0389	<0.000001	0.0295	0.0013	0.00004	0.0571	0.0070	0.0165	0.0185
3	0.0300	0.0030	0.0031	0.0026	0.0395	<0.00001	0.0323	0.0013	0.0002	0.0580	0.0093	0.0170	0.0190
4	0.0300	0.0041	0.0033	0.0046	0.0400	<0.005	0.0330	0.0013	0.0003	0.0599	0.0098	0.0176	0.0199
5	0.0300	0.0041	0.0034	0.0057	0.0400		0.0333	0.0015	0.0030	0.0600	0.0098	0.0189	0.0200
6	0.0303	0.0049	0.0037	0.0062	0.0404		0.0336	0.0016	<0.0005	0.0600	0.0099	0.0193	0.0201
7	0.0305	0.0049	0.0038	0.0063	0.0405		0.0343	0.0018	<0.001	0.0602	0.0112	0.0195	0.0209
8	0.0308	0.0050	0.0039	0.0070	0.0406		0.0347	0.0018	<0.0010	0.0607	0.0114	0.0197	0.0216
9	0.0327	0.0051	0.0050	0.0092	0.0406		0.0350	0.0019	<0.002	0.0620	0.0117	0.0201	0.0350
10	0.0334	0.0053	0.0050		0.0414		0.0350	0.0020	<0.002	0.0623	0.0121	0.0202	
11	0.0345	0.0059	0.0060		0.0417		0.0351	0.0020	<0.005	0.0631	0.0122	0.0211	
12	0.0360	0.0063	0.0077		0.0424		0.0353	0.0030		0.0670	0.0126		
13	0.0370	0.0080	0.0085		0.0430		0.0371	<0.001		0.0677	0.0128		
14	0.0400	0.0100	0.0090		0.0432		0.0380	<0.002		0.0684	0.0130		
15	0.0439	<0.002	<0.002				0.0390	<0.002		0.0710	0.0130		
16		<0.005	<0.002				0.0403	<0.003			0.0143		
17								<0.005			0.0150		
18											<0.002		
Mean	0.0329	0.0052	0.0047	0.0050	0.0407	0.0040	0.0344	0.0017	0.0007	0.0623	0.0112	0.0186	0.0206
STDV	0.0047	0.0020	0.0023	0.0026	0.0017		0.0036	0.0005	0.0013	0.0043	0.0025	0.0018	0.0063
Certified	0.033	0.005	0.005	0.005	0.041	(0.004)	0.034	0.0017	(0.001)	0.062	0.011	0.019	0.021
U _{CRM}	0.003	0.001	0.001	0.002	0.001		0.002	0.0004		0.002	0.002	0.001	0.005
Methods	I,G,IM,A,X	I,G,IM,X	I,G,IM,X	G,I,IM	I,G,IM,A,X	I,G	I,G,IM,A	I,G,IM,A,X	I,G,IM,X	G,I,IM,A,X	I,G,IM,A,X	G,I,IM	G,I,IM,X

	Hg	In	Mg	Mo	Ni	P	Pb	S	Sb	Se	Sn	Te	Tl	Zn
1	0.0280	0.0438	0.00001	0.0010	0.0110	0.0017	0.1330	0.00003	0.0437	0.0007	99.420	0.0143	0.00002	0.0033
2	0.0370	0.0452	0.0002	<0.000001	0.0120	0.0025	0.1373	0.0001	0.0550	0.0008	99.487	0.0171	0.00002	0.0037
3	0.0390	0.0463	0.0003	<0.00001	0.0120	0.0067	0.1380	0.0025	0.0570	0.0008		0.0180	0.0001	0.0040
4	0.0421	0.0470	<0.000001		0.0125	0.0070	0.1390	0.0034	0.0572	0.0009		0.0184	<0.001	0.0041
5	0.0428	0.0471	<0.000005		0.0125	<0.000001	0.1400	0.0040	0.0650	0.0021		0.0187	<0.0010	0.0044
6	0.0519	0.0484	<0.0005		0.0128	<0.00001	0.1400	<0.0005	0.0687	0.0032		0.0188		0.0046
7	0.0570	0.0498	<0.001		0.0128	<0.002	0.1432	<0.0010	0.0690	0.0058		0.0199		0.0047
8	0.0575	0.0519	<0.001		0.0129	<0.002	0.1470	<0.002	0.0702	<0.0005		0.0280		0.0047
9	0.0577	0.0520	<0.0010		0.0130	<0.005	0.1470	<0.002	0.0710	<0.001		0.0286		0.0047
10		0.0530	<0.005		0.0134	<0.0050	0.1497		0.0717	<0.005				0.0049
11					0.0135		0.1511		0.0720	<0.0050				0.0050
12					0.0136		0.1520		0.0721					0.0051
13					<0.002		0.1523		0.0740					0.0053
14					<0.005		0.1580		0.0746					<0.002
15							0.1589		0.0776					<0.002
16							0.1607		0.0845					<0.005
17									0.0856					
18														
Mean	0.0459	0.0485	0.0002	0.0010	0.0127	0.0045	0.1467	0.0020	0.0688	0.0020	99.453	0.0202	0.00003	0.0045
STDV	0.0106	0.0031	0.0001		0.0007	0.0028	0.0085	0.0019	0.0106	0.0019	0.0471	0.0049	0.00003	0.0006
Certified	0.046	0.048	(0.0002)	(0.001)	0.0127	(0.004)	0.147	(0.002)	0.069	0.002	(99.5)	0.020	(0.00003)	0.0045
U _{CRM}	0.008	0.002			0.0005		0.005		0.006	0.002		0.004		0.0004
Methods	G,I,IM,X,A	I,IM	I,G,IM	I,G	I,G,IM,A,X	I,G,X,IM	I,G,IM,A,X	G,C,I,X	I,G,IM,A,X	I,G,IM,X	I	G,I,IM	G,IM,I	I,G,IM,A,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

The following data was analyzed by GDMS and is intended for informational purposes only

	B	Ba	Be	Br	Ce	Cl	Cs	Dy	Er	Eu	F	Gd
1	<0.0000005	<0.0000005	<0.0000005	<0.0000005	<0.0000005	<0.000001	<0.000005	<0.0000005	<0.0000005	<0.000001	<0.000005	<0.0000005
2	<0.000001	<0.000005	<0.000001	<0.0001	<0.000005	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	<0.00001	<0.000005

	Hf	Ho	I	Ir	K	La	Li	Lu	Mn	Na	Nb	Nd
1	<0.000001	<0.0000005	<0.000005	<0.000001	0.00001	<0.0000005	<0.0000005	<0.0000005	<0.0000005	0.000002	<0.0000005	<0.0000005
2	<0.000005	<0.000005	<0.000005	<0.00001	<0.000001	<0.000005	<0.000001	<0.000005	<0.000005	<0.000001	<0.000005	<0.000005

	Os	Pd	Pr	Pt	Rb	Re	Rh	Ru	Sc	Si	Sm	Sr
1	<0.000001	0.0005	<0.0000005	<0.000001	<0.0000005	<0.000001	0.0003	0.00001	<0.0000001	0.00001	<0.0000005	<0.0000005
2	<0.00001	<0.0001	<0.000005	<0.00001	<0.000005	<0.000005	<0.0001	<0.00001	<0.000005	0.00002	<0.000005	<0.000005

	Ta	Tb	Th	Ti	Tm	U	V	W	Y	Yb
1	<0.00001	<0.0000005	<0.0000005	0.000002	<0.0000005	<0.0000005	0.000001	<0.000001	<0.0000005	<0.0000005
2	<0.0005	<0.000005	<0.000005	0.000005	<0.000005	<0.000005	0.00002	<0.00001	<0.000005	<0.000005