

Certified Reference Material

Certificate of Analysis



Product ID: MBH-86X PSS1 C

Product Description: Pb/Sn/Sb Babbit

Revision No.: 000
 Revision Date: 09/29/2022

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	0.0038	± 0.0005	Cd	0.0054	± 0.0003	Ni	0.0057	± 0.0008	Sn	4.49	± 0.04
As	0.54	± 0.01	Cu	0.031	± 0.001	S	0.0054	± 0.0006	Te	0.0022	± 0.0008
Bi	0.201	± 0.005	In	0.0079	± 0.0008	Sb	11.84	± 0.09	Zn	0.0013	± 0.0006

Indicative Values listed in ppm unless otherwise stated					
Al (40)	Fe (38)	Mg (7)	Pb (86.7%)	Pd (16)	

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.

- AIM - Alpha Assembly Solutions
- Alpha Assembly Solutions - Dirats Laboratories
- Dirats Laboratories - Lukaszewicz Instytut Metali Niezależnych
- Lukaszewicz Instytut Metali Niezależnych - IMR Test Labs
- IMR Test Labs - Inppamet Anodos
- Inppamet Anodos - LGC Standards
- LGC Standards - NSL Analytical Services
- NSL Analytical Services - Scrooby's Laboratory Service CC
- Scrooby's Laboratory Service CC - SGS MSI
- SGS MSI - Sheffield Assay Office
- Sheffield Assay Office - TEC Eurolab
- TEC Eurolab - Universal Scientific Laboratory Pty Ltd.
- Universal Scientific Laboratory Pty Ltd. -

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.


Chuck Goudreau, Certifying Officer

29 September 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	Bi	Cd	Cu	Fe	In	Mg	Ni	Pd	S	Sb
1	0.0019	0.0040	0.5010	0.1870	0.0045	0.0277	0.0011	0.0068	0.0001	0.0042	0.0010	0.0034	11.50
2	0.0029		0.5120	0.1910	0.0046	0.0288	0.0021	0.0069	0.0001	0.0043	0.0012	0.0050	11.57
3	0.0030		0.5210	0.1910	0.0048	0.0290	0.0022	0.0070	0.0006	0.0046	0.0020	0.0050	11.70
4	0.0031		0.5220	0.1910	0.0049	0.0290	0.0023	0.0070	0.0022	0.0051	0.0023	0.0051	11.77
5	0.0031		0.5280	0.1965	0.0049	0.0290	0.0030	0.0071	<0.0001	0.0052	<0.001	0.0052	11.78
6	0.0032		0.5287	0.1970	0.0050	0.0295	0.0030	0.0076	<0.0005	0.0052	<0.005	0.0052	11.79
7	0.0034		0.5330	0.1990	0.0050	0.0300	0.0050	0.0076	<0.001	0.0053		0.0052	11.84
8	0.0038		0.5346	0.1990	0.0050	0.0300	0.0066	0.0083	<0.0010	0.0053		0.0054	11.86
9	0.0040		0.5410	0.2010	0.0054	0.0300	0.0085	0.0091	<0.005	0.0057		0.0056	11.90
10	0.0040		0.5425	0.2030	0.0055	0.0304	<0.001	0.0097	<0.005	0.0058		0.0058	11.91
11	0.0041		0.5490	0.2040	0.0060	0.0307	<0.001	0.0098	<0.005	0.0068		0.0066	11.91
12	0.0050		0.5530	0.2080	0.0061	0.0307	<0.0010	<0.001	<0.005	0.0080		0.0074	11.94
13	0.0050		0.5540	0.2083	0.0061	0.0312	<0.002			0.0087		<0.001	11.99
14	0.0050		0.5630	0.2100	0.0061	0.0318	<0.005			<0.001		<0.0100	11.99
15	0.0053		0.5697	0.2100	0.0063	0.0324				<0.005			12.00
16	<0.005			0.2190		0.0340							12.05
17						0.0368							
18						0.0370							
Mean	0.0038	0.0040	0.5368	0.2009	0.0054	0.0310	0.0038	0.0079	0.0007	0.0057	0.0016	0.0054	11.843
STDV	0.0010		0.0190	0.0087	0.0006	0.0026	0.0024	0.0011	0.0010	0.0014	0.0006	0.0010	0.155
Certified	0.0038	(0.004)	0.54	0.201	0.0054	0.031	(0.0038)	0.0079	(0.0007)	0.0057	(0.0016)	0.0054	11.84
U _{CRM}	0.0005		0.01	0.005	0.0003	0.001		0.0008		0.0008		0.0006	0.09
Methods	IM,O,I,A,X	I	IM,O,I,X	I,O,X,A	IM,O,I,A,X	I,O,A,X,IM	IM,I,A,X,O	I,O,IM	I,IM,X,O	IM,O,I,A	I,IM	I,O,A,X,C	I,O,X,W

	Sn	Te	Zn
1	4.344	0.0010	0.0004
2	4.390	0.0013	0.0008
3	4.390	0.0013	0.0008
4	4.400	0.0014	0.0009
5	4.436	0.0023	0.0012
6	4.442	0.0029	0.0013
7	4.460	0.0030	0.0016
8	4.486	0.0034	0.0017
9	4.500	0.0036	0.0031
10	4.513	<0.001	<0.001
11	4.520	<0.001	<0.002
12	4.540	<0.0010	<0.002
13	4.541	<0.002	<0.005
14	4.550	<0.002	
15	4.560	<0.002	
16	4.574	<0.005	
17	4.620		
18			
Mean	4.486	0.0022	0.0013
STDV	0.0768	0.0010	0.0008
Certified	4.49	0.0022	0.0013
U _{CRM}	0.04	0.0008	0.0006
Methods	I,O,X,A	I,O,IM,A,X	IM,I,A,X,O

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