

Certificate of Analysis

MBH 74X CA3 C

Tin-Base Lead-Free Solder

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Ag	3.02 ± 0.06	Al	0.0005 ± 0.0002	As	0.0022 ± 0.0005	Au	0.0087 ± 0.0007
Bi	0.016 ± 0.001	Cd	0.0023 ± 0.0002	Co	0.0053 ± 0.0002	Cu	0.071 ± 0.002
Fe	0.0036 ± 0.0007	Ge	0.002 ± 0.001	In	0.0052 ± 0.0004	Ni	0.0053 ± 0.0003
P	0.025 ± 0.001	Pb	0.033 ± 0.001	Sb	0.033 ± 0.001	Zn	0.0008 ± 0.0004

Description and Intended Use

This Certified Reference Material has been produced and certified, wherever possible, in accordance with the requirements of ISO 17034 and the associated Guides, taking into account the requirements of the ISO Guide to the Expression of Uncertainty in Measurement (GUM). 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.

Instructions for Use

1. The test surface is on the opposite side of the labeled surface, which includes the material identification. The entire thickness of the unit is certified. However, the user is cautioned not to measure disks less than 2 mm thick when using X-ray fluorescence spectrometry. 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.
2. 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.
3. The material should be stored in a cool, dry location when not in use.
4. Chips are not recommended for gas analysis.

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

	Ag	Al	As	Au	Bi	Cd	Co	Cu	Fe	Ge	In	Ni	P	Pb	Sb	Zn
1	3.182	0.0011	0.0034	0.0103	0.0208	0.0032	0.0062	0.0776	0.0052	0.0050	0.0061	0.0064	0.0285	0.0370	0.0360	0.0027
2	3.173	0.0007	0.0033	0.0100	0.0170	0.0027	0.0058	0.0741	0.0051	0.0031	0.0060	0.0059	0.0279	0.0365	0.0353	0.0015
3	3.155	0.0006	0.0030	0.0097	0.0167	0.0027	0.0057	0.0724	0.0047	0.0030	0.0059	0.0058	0.0273	0.0358	0.0350	0.0013
4	3.091	0.0005	0.0023	0.0095	0.0157	0.0026	0.0057	0.0723	0.0047	0.0019	0.0058	0.0055	0.0259	0.0355	0.0346	0.0010
5	3.088	0.0005	0.0022	0.0094	0.0154	0.0026	0.0056	0.0720	0.0045	0.0014	0.0057	0.0055	0.0257	0.0353	0.0345	0.0009
6	3.073	0.0004	0.0022	0.0090	0.0154	0.0026	0.0056	0.0719	0.0045	0.0010	0.0053	0.0054	0.0254	0.0346	0.0344	0.0008
7	3.061	0.0004	0.0021	0.0085	0.0152	0.0024	0.0053	0.0717	0.0041	0.0009	0.0052	0.0054	0.0252	0.0344	0.0341	0.0008
8	3.050	0.0003	0.0021	0.0083	0.0151	0.0023	0.0053	0.0706	0.0038	0.0009	0.0049	0.0053	0.0249	0.0330	0.0334	0.0007
9	3.045	0.0002	0.0020	0.0079	0.0151	0.0022	0.0052	0.0705	0.0036	0.0005	0.0049	0.0053	0.0248	0.0325	0.0329	0.0006
10	3.029	0.0002	0.0020	0.0078	0.0150	0.0021	0.0052	0.0704	0.0034		0.0048	0.0052	0.0244	0.0324	0.0322	0.0005
11	3.028	0.0002	0.0019	0.0078	0.0149	0.0021	0.0051	0.0694	0.0030		0.0047	0.0051	0.0241	0.0321	0.0322	0.0004
12	3.016		0.0012	0.0068	0.0143	0.0021	0.0051	0.0690	0.0025		0.0044	0.0051	0.0231	0.0319	0.0314	0.0004
13	3.016		0.0006		0.0139	0.0020	0.0050	0.0689	0.0024		0.0043	0.0049	0.0224	0.0314	0.0309	0.0002
14	2.943				0.0136	0.0019	0.0049	0.0682	0.0022			0.0046	0.0220	0.0309	0.0308	0.0002
15	2.905					0.0018	0.0049	0.0677	0.0020			0.0045		0.0302	0.0290	0.0001
16	2.903					0.0013	0.0047	0.0613	0.0012					0.0292		
17	2.844													0.0275		
18	2.759															
19																
20																
Mean	3.020	0.0005	0.0022	0.0087	0.0156	0.0023	0.0053	0.0705	0.0036	0.0020	0.0052	0.0053	0.0251	0.0330	0.0331	0.0008
STDV.	0.113	0.0003	0.0008	0.0011	0.0018	0.0005	0.0004	0.0035	0.0012	0.0015	0.0006	0.0005	0.0019	0.0027	0.0020	0.0007
Certified	3.02	0.0005	0.0022	0.0087	0.016	0.0023	0.0053	0.071	0.0036	0.002	0.0052	0.0053	0.025	0.033	0.033	0.0008
U _{CRM}	0.06	0.0002	0.0005	0.0007	0.001	0.0002	0.0002	0.002	0.0007	0.001	0.0004	0.0003	0.001	0.001	0.001	0.0004
Methods	I,W,A	I,A	I,A	I,A	I,A	I,A	I,A	I,A,W	I,A	I	I,A	I,A	I,W	I,A,W	I,A,W	I,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

Certification Laboratories

Element - Teesside	Middlesbrough, England	AMG Superalloys UK Ltd	Rotherham, England
Sheffield Analytical Services Ltd.	Sheffield, England	Universal Scientific Laboratory PTY Ltd	Milperra, NSW, Australia
Mineral & Metallurgical Laboratories	Bangalore, India	Luo Yang Copper Co	Lou Yang, He Nan, China
Raghavendra SpectroMet Laboratory	Bangalore, India	TCR Engineering Services Pvt Ltd	Mumbai, India
AnchorCert Analytical	Birmingham, England	Shanghai Jinyi Test Technology Co. Ltd.	Shanghai, China
National R&D Institute for Non-Ferrous Metals	Romania	Analyticka Laborator, Lithea s.r.o.	Brno, Czech Republic
Tec-Eurolab	Campogalliano, Italy	Genitest Inc.	Montreal, Canada
INCDMNR-IMNR	Pantelimon, Romania	LGC Standards	Manchester, NH

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.

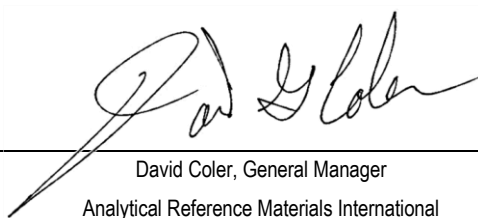
Homogeneity and Uncertainty

"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 spark OES 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 spark OES. 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.

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

Expiration

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.



David Coler, General Manager
Analytical Reference Materials International