

Certificate of Analysis

IARM Cu172-18

Copper Alloy / CDA 172 / UNS C17200

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.022 ± 0.001	Be	1.79 ± 0.02	Co	0.344 ± 0.006	Cr	0.0007 ± 0.0003
Cu	97.7 ± 0.1	Fe	0.029 ± 0.001	Mn	0.0017 ± 0.0004	Ni	0.010 ± 0.001
P	0.003 ± 0.003	Pb	0.005 ± 0.003	Si	0.057 ± 0.002	Sn	0.0009 ± 0.0004
Zn	0.008 ± 0.001						

Indicative Values listed in ppm

Ag (20)	As (<50)	B (<50)	Bi (<50)	C (30)	Cd (<50)	Mg (13)
Mo (<50)	N (<10)	O (<50)	S (10)	Sb (10)	Se (<50)	Ti (<50)
Zr (<50)						

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** certified laboratories. This CRM may come in the form of a solid disk, chips, or powder. 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	B	Be	Bi	C	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	N
1	0.0008	0.01881	0.0002	0.0001	1.759	0.00086	0.001	0.0007	0.3295	0.0004	97.607	0.0261	0.001	0.001	0.005	0.0002
2	0.001	0.0205	<0.001	<0.001	1.76	0.00155	0.00125	<0.001	0.33	0.0005	97.61	0.0267	0.0013	0.0015	<0.001	0.0002
3	0.003	0.021	<0.005	<0.001	1.77	<0.001	0.0023	<0.001	0.334	0.0006	97.668	0.0267	0.0014	0.0017	<0.005	0.0008
4	0.0034	0.0214	<0.005	<0.005	1.7767	<0.001	0.003	<0.005	0.336	0.00073	97.668	0.0273	0.0016	0.0018		0.001
5	0.0034	0.0214			1.787	<0.005	0.0071		0.34	0.001	97.695	0.0283	<0.001	0.0019		<0.001
6		0.022			1.787		<0.005		0.34	0.001	97.80	0.029	<0.005	0.002		<0.001
7		0.022			1.79				0.3444		97.937	0.029				<0.001
8		0.0225			1.827				0.3444			0.029				
9		0.023			1.8335				0.346			0.03				
10		0.024			1.836				0.347			0.03				
11		0.0241							0.352			0.03				
12		0.026							0.3556			0.0302				
13									0.368			0.0317				
14																
15																
Mean	0.002	0.022			1.79	0.0010	0.003		0.344	0.0007	97.7	0.029	0.0013	0.0017		0.0006
STDV.	0.001	0.002			0.03	0.0005	0.002		0.01	0.0003	0.1	0.002	0.0003	0.0004		0.0004
Certified	(0.002)	0.022	(<0.005)	(<0.005)	1.79	(<0.005)	(0.003)	(<0.005)	0.344	0.0007	97.7	0.029	(0.0013)	0.0017	(<0.005)	(<0.001)
U _{CRM}	0.001	0.001			0.02				0.006	0.0003	0.1	0.001		0.0004		
Methods	O,I	O,I,IM	O,I,IM	I,IM	O,I	O,I,IM,X	C,O	O,I,IM	O,I,X,IM	O,I,IM,X	O,X,I	O,I,X,IM	I,IM	O,I,IM	IM,I	F

	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Ti	Zn	Zr				
1	0.0078	0.0004	0.00095	0.0007	0.0003	0.00089	0.0006	0.05155	0.0004	0.0011	0.0052	0.0002				
2	0.0079	0.0004	0.00116	0.00071	0.0003	0.0011	<0.001	0.053	0.0005	0.004	0.007	<0.001				
3	0.008	0.001	0.0017	0.001	0.0006	<0.001	<0.005	0.053	0.00088	<0.001	0.007	<0.001				
4	0.0086	0.004	0.002	0.001	0.002	<0.001	<0.005	0.0568	0.0009	<0.005	0.0079	<0.005				
5	0.009	<0.001	0.006	0.004	<0.001	<0.005		0.057	0.001		0.008					
6	0.0093	<0.001	0.008	0.006				0.057	0.00155		0.0081					
7	0.01			0.00925				0.057			0.00825					
8	0.0106			0.00945				0.0585			0.009					
9	0.011			0.0098				0.059			0.0097					
10	0.011							0.059								
11	0.011							0.06								
12	0.0115							0.062								
13	0.0124							0.0621								
14	0.0124															
15	0.014															
Mean	0.01	0.001	0.003	0.005	0.0010	0.0010		0.057	0.0009		0.008					
STDV.	0.002	0.002	0.003	0.004	0.0008	0.0001		0.003	0.0004		0.001					
Certified	0.010	(<0.005)	0.003	0.005	(0.001)	(0.001)	(<0.005)	0.057	0.0009	(<0.005)	0.008	(<0.005)				
U _{CRM}	0.001	0.003	0.003	0.003				0.002	0.0004		0.001					
Methods	O,I,X,IM	F	O,I,IM,X	O,I,IM,X	I,C	O,I,IM,X	I,IM	O,I,X,IM	O,I,IM,X	IM,I	O,I,IM,X	I,IM				

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

Laboratorio Prove Materiali S. Marco srl	Schio, Italy	Laboratory Testing, Inc.	Hatfield, PA
Anderson Laboratories, Inc.	Greendale, WI	revierlabor GmbH	Essen, Germany
Sipi-Metals Corp	Chicago, IL	NSL Analytical Services	Cleveland, OH
IMR Test Labs	Lansing, NY	Dirats Laboratories	Westfield, MA
Applied Technical Services	Marietta, GA	EAG Laboratories	Liverpool, NY
LGC Standards	Manchester, NH		

Certification laboratories have demonstrated performance and traceability or utilized a variety of test methods under the scope of ISO 17025. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

NIST 400 NIST 1122 NIST 1124 IARM 70A IARM 71A IARM 71B IARM 75B MBH 17869 MBH-39X 17870

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.

$$1. N_{min} = \max(10, \sqrt[3]{N_{prod}})$$

$$2. U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

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

