

Certified Reference Material **Certificate of Analysis**

Product ID: IARM-Cu844-18

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Leaded Semi-Red Brass, Copper Alloy, CDA 844 / C84400

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	0.0133	± 0.0009	Al	0.0010	± 0.0004	As	0.0041	± 0.0005	Bi	0.030	± 0.003
Cd	0.0008	± 0.0005	Co	0.0015	± 0.0002	Cr	0.0005	± 0.0005	Cu	80.5	± 0.4
Fe	0.030	± 0.001	Ni	0.209	± 0.004	P	0.0018	± 0.0004	Pb	6.7	± 0.2
S	0.023	± 0.002	Sb	0.037	± 0.001	Se	0.0040	± 0.0007	Sn	3.08	± 0.03
Zn	9.5	± 0.2									

Indicative Values listed in ppm

Mg (<65) Mn (3) O (<17) Si (10)

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-recognised 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
- NSL Analytical Services - Cleveland, OH
- Laboratory Testing, Inc. - Hatfield, PA
- Universal Scientific Laboratory - Revesby, Australia
- Connecticut Metallurgical, Inc. - East Hartford, CT
- IMR Test Labs - Lansing, NY
- SGS MSI - Melrose Park, IL
- Scrooby's Laboratory Service - Rynfield, South Africa
- AnchorCert Analytical - Birmingham, UK
- Sheffield Assay Office - Sheffield, UK
- EAG Laboratories - Liverpool, NY
- TCR Engineering Services - Maharashtra, India
- Institute of Non-Ferrous Metals - Gliwice, Poland
- Applied Technical Services - Marietta, GA

Instructions for Use: 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. 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

November 5, 2021
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	Co	Cr	Cu	Fe	Mg	Mn	Ni	O
1	0.0100	0.0002	0.0030	0.0233	0.0001	0.0010	0.0001	79.450	0.0260	0.0002	0.00002	0.1990	0.0016
2	0.0105	0.0005	0.0030	0.0237	0.0001	0.0010	0.0001	79.740	0.0260	0.0061	0.00005	0.2010	0.0017
3	0.0120	0.0007	0.0030	0.0240	0.0001	0.0012	0.0002	79.900	0.0270		0.0001	0.2020	
4	0.0125	0.0010	0.0036	0.0250	0.0002	0.0015	0.0003	79.960	0.0274		0.0003	0.2053	
5	0.0126	0.0010	0.0036	0.0255	0.0003	0.0015	0.0010	80.070	0.0275		0.0003	0.2060	
6	0.0130	0.0010	0.0037	0.0256	0.0007	0.0016	0.0010	80.433	0.0280		0.0008	0.2060	
7	0.0130	0.0012	0.0039	0.0258	0.0011	0.0016	<0.0005	80.500	0.0286		<0.0001	0.2073	
8	0.0133	0.0020	0.0040	0.0260	0.0012	0.0016	<0.0005	80.760	0.0290		<0.0001	0.2080	
9	0.0133	<0.0001	0.0040	0.0261	0.0015	0.0016	<0.0005	80.890	0.0290		<0.0005	0.2090	
10	0.0134	<0.0001	0.0045	0.0265	0.0016	0.0017	<0.001	80.900	0.0290		<0.0005	0.2094	
11	0.0136	<0.0005	0.0046	0.0268	0.0019	0.0018	<0.001	80.948	0.0295		<0.001	0.2100	
12	0.0140	<0.001	0.0047	0.0269	<0.0001	0.0020	<0.001	81.008	0.0300		<0.001	0.2112	
13	0.0140	<0.0010	0.0049	0.0270	<0.0005	0.0020	<0.0010	81.380	0.0308		<0.002	0.2150	
14	0.0140	<0.002	0.0050	0.0277	<0.0005	<0.0005	<0.002		0.0309		<0.002	0.2177	
15	0.0147	<0.002	0.0058	0.0350	<0.001	<0.002	<0.002		0.0312		<0.002	0.2205	
16	0.0159	<0.002	<0.005	0.0380	<0.002	<0.002	<0.005		0.0320		<0.005	0.2216	
17	0.0170	<0.005	<0.005	0.0380	<0.002	<0.005			0.0343				
18				0.0420	<0.005				0.0350				
19				0.0430									
20				0.0430									
Mean	0.0133	0.0010	0.0041	0.0299	0.0008	0.0015	0.0005	80.457	0.0295	0.0032	0.0003	0.2093	0.0017
STDV	0.0017	0.0005	0.0008	0.0069	0.0007	0.0003	0.0004	0.5852	0.0025	0.0042	0.0003	0.0066	0.0001
Certified	0.0133	0.0010	0.0041	0.030	0.0008	0.0015	0.0005	80.5	0.030	(<0.0065)	(0.0003)	0.209	(<0.0017)
U _{CRM}	0.0009	0.0004	0.0005	0.003	0.0005	0.0002	0.0005	0.4	0.001			0.004	
Methods	O,I,IM,X,A	O,I,IM,X	I,IM,O,X	O,I,IM,X	O,I,IM,X,A	O,I,IM,X,A	O,I,IM,X,A	O,W,I,X	O,I,IM,X,A	O,X	O,I,IM,X,A	I,O,IM,X,A	IM,F

	P	Pb	S	Sb	Se	Si	Sn	Zn
1	0.0009	6.4100	0.0159	0.0330	0.0015	0.0002	2.9680	8.7540
2	0.0010	6.4810	0.0185	0.0335	0.0030	0.0002	2.9690	8.8063
3	0.0012	6.5280	0.0187	0.0350	0.0031	0.0003	3.0000	8.8561
4	0.0014	6.5300	0.0208	0.0354	0.0032	0.0009	3.0000	8.9270
5	0.0018	6.6200	0.0210	0.0360	0.0040	0.0017	3.0142	9.1700
6	0.0020	6.6400	0.0220	0.0366	0.0040	0.0025	3.0360	9.3290
7	0.0021	6.6700	0.0220	0.0367	0.0041	0.0043	3.0500	9.3600
8	0.0023	6.6998	0.0231	0.0370	0.0041	<0.0001	3.0800	9.4000
9	0.0025	6.7050	0.0240	0.0370	0.0042	<0.0005	3.0827	9.4200
10	0.0025	6.7300	0.0240	0.0374	0.0043	<0.002	3.0880	9.5127
11	<0.001	6.7890	0.0240	0.0376	0.0045	<0.002	3.0910	9.5690
12	<0.002	6.8440	0.0244	0.0380	0.0050	<0.002	3.1036	9.5800
13	<0.002	6.8900	0.0247	0.0380	0.0052	<0.0025	3.1140	9.7050
14	<0.002	6.9300	0.0251	0.0381	0.0063	<0.005	3.1190	9.7180
15	<0.005	7.0000	0.0257	0.0390	<0.002	<0.005	3.1370	9.7800
16	<0.005	7.0500	0.0270	0.0390	<0.005		3.1526	9.8130
17		7.0600	0.0280	0.0402	<0.005		3.1626	9.8430
18							3.1900	9.9500
19							3.1920	10.120
20								10.379
Mean	0.0018	6.7398	0.0229	0.0369	0.0040	0.0014	3.0816	9.4996
STDV	0.0006	0.1992	0.0032	0.0019	0.0011	0.0015	0.0700	0.4418
Certified	0.0018	6.7	0.023	0.037	0.0040	(0.001)	3.08	9.5
U _{CRM}	0.0004	0.2	0.002	0.001	0.0007		0.03	0.2
Methods	I,IM,O,X,W	O,I,IM,X,A	O,C,I,IM,X	O,I,IM,X,A	O,I,IM,X	O,IM,I,X,A,W	O,I,X,W	O,I,X,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

