

Certified Reference Material **Certificate of Analysis**

Product ID: IARM-Cu836-18

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Leaded Red Brass, Copper Alloy, CDA 836 / C83600

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	0.0292	± 0.0008	As	0.0098	± 0.0006	Bi	0.035	± 0.002	Cd	0.0014	± 0.0002
Co	0.0026	± 0.0004	Cu	84.5	± 0.2	Fe	0.049	± 0.002	Nb	0.002	± 0.001
Ni	0.423	± 0.005	P	0.028	± 0.001	Pb	4.9	± 0.1	S	0.041	± 0.002
Sb	0.103	± 0.005	Se	0.0016	± 0.0004	Sn	5.02	± 0.04	Zn	5.09	± 0.05

Indicative Values listed in ppm
Al (40) Cr (7) Mn (2) O (<10) Si (30)

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
- 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	Mn	Nb	Ni	O
1	0.0263	0.0001	0.0070	0.0279	0.0006	0.0010	0.0002	83.9000	0.0430	0.0001	0.0001	0.4020	0.0006
2	0.0271	0.0006	0.0080	0.0300	0.0010	0.0015	0.0003	83.9100	0.0430	0.0001	0.0007	0.4090	0.0010
3	0.0280	0.0010	0.0080	0.0322	0.0010	0.0015	0.0006	84.2833	0.0460	0.0001	0.0007	0.4150	
4	0.0280	0.0010	0.0080	0.0330	0.0013	0.0019	0.0010	84.3430	0.0460	0.0001	0.0020	0.4160	
5	0.0285	0.0011	0.0086	0.0330	0.0014	0.0025	0.0010	84.4000	0.0461	0.0002	0.0020	0.4170	
6	0.0285	0.0050	0.0092	0.0333	0.0014	0.0027	0.0013	84.4000	0.0469	0.0002	0.0021	0.4192	
7	0.0286	0.0050	0.0094	0.0340	0.0014	0.0030	<0.00005	84.4100	0.0475	0.0009	0.0030	0.4200	
8	0.0287	0.0050	0.0100	0.0340	0.0015	0.0030	<0.0001	84.5200	0.0486	<0.0001	<0.00005	0.4200	
9	0.0295	0.0050	0.0100	0.0344	0.0015	0.0030	<0.0005	84.5300	0.0490	<0.0005	<0.0001	0.4210	
10	0.0297	0.0055	0.0100	0.0351	0.0017	0.0030	<0.0005	84.5400	0.0490	<0.0005	<0.001	0.4210	
11	0.0297	0.0160	0.0100	0.0351	0.0017	0.0030	<0.001	84.5700	0.0500	<0.001	<0.001	0.4210	
12	0.0300	<0.00005	0.0102	0.0353	0.0018	0.0031	<0.001	84.6500	0.0500	<0.001	<0.005	0.4248	
13	0.0303	<0.0001	0.0103	0.0360	0.0022	0.0031	<0.001	84.9900	0.0502	<0.002		0.4264	
14	0.0308	<0.0005	0.0104	0.0364	<0.0005	0.0032	<0.001	84.9900	0.0512	<0.002		0.4267	
15	0.0310	<0.001	0.0104	0.0370	<0.002	0.0037	<0.002		0.0517	<0.002		0.4280	
16	0.0322	<0.001	0.0108	0.0373	<0.002	<0.002	<0.002		0.0520	<0.005		0.4280	
17		<0.001	0.0110	0.0380	<0.005	<0.002	<0.005		0.0533			0.4284	
18		<0.005	0.0110	0.0390		<0.005			0.0540			0.4350	
19			0.0111	0.0410					0.0540			0.4405	
20			0.0117									0.4473	
Mean	0.0292	0.0041	0.0098	0.0348	0.0014	0.0026	0.0007	84.4597	0.0490	0.0002	0.0015	0.4233	0.0008
STDV	0.0015	0.0045	0.0013	0.0031	0.0004	0.0008	0.0004	0.3157	0.0033	0.0003	0.0010	0.0102	0.0003
Certified	0.0292	(0.004)	0.0098	0.035	0.0014	0.0026	(0.0007)	84.5	0.049	(0.0002)	0.002	0.423	(<0.001)
U _{CRM}	0.0008		0.0006	0.002	0.0002	0.0004		0.2	0.002		0.001	0.005	
Methods	O,I,IM,X,A	O,I,IM,X	O,I,IM,X	O,I,IM,X	O,I,IM,X,A	O,I,IM,X,A	O,I,IM,X	O,I,W,X	O,I,IM,X,A	O,I,IM,X,A	O,I,IM	O,I,IM,X,A	F

	P	Pb	S	Sb	Se	Si	Sn	Zn
1	0.0240	4.6880	0.0346	0.0870	0.0006	0.0001	4.9210	4.8590
2	0.0244	4.7450	0.0350	0.0870	0.0007	0.0005	4.9250	4.9790
3	0.0260	4.7640	0.0360	0.0906	0.0013	0.0016	4.9600	4.9820
4	0.0260	4.7833	0.0361	0.0938	0.0013	0.0030	4.9617	4.9915
5	0.0260	4.7960	0.0367	0.0960	0.0014	0.0035	4.9770	5.0130
6	0.0261	4.8247	0.0375	0.0960	0.0015	0.0038	4.9930	5.0283
7	0.0265	4.8420	0.0377	0.0970	0.0015	0.0040	4.9970	5.0300
8	0.0267	4.8660	0.0379	0.0980	0.0015	0.0048	5.0170	5.0400
9	0.0270	4.8780	0.0395	0.0984	0.0020	<0.0001	5.0200	5.0500
10	0.0272	4.9210	0.0411	0.1010	0.0020	<0.0001	5.0310	5.0800
11	0.0276	4.9229	0.0430	0.1030	0.0021	<0.0005	5.0450	5.1000
12	0.0280	4.9490	0.0440	0.1036	0.0022	<0.002	5.0680	5.1080
13	0.0281	5.0700	0.0450	0.1072	0.0030	<0.002	5.0760	5.1540
14	0.0285	5.1500	0.0450	0.1080	<0.002	<0.002	5.0840	5.1630
15	0.0290	5.1500	0.0450	0.1082	<0.005	<0.0025	5.1100	5.1920
16	0.0291	5.2060	0.0470	0.1110	<0.005	<0.005	5.1140	5.2050
17	0.0295	5.3140	0.0482	0.1140		<0.005		5.2100
18	0.0300			0.1168				5.2160
19	0.0316			0.1184				5.2520
20	0.0320			0.1200				
Mean	0.0277	4.9335	0.0405	0.1028	0.0016	0.0027	5.0187	5.0870
STDV	0.0021	0.1813	0.0045	0.0100	0.0006	0.0017	0.0612	0.1039
Certified	0.028	4.9	0.041	0.103	0.0016	(0.003)	5.02	5.09
U _{CRM}	0.001	0.1	0.002	0.005	0.0004		0.04	0.05
Methods	O,I,IM,X,W	O,I,X,A	O,C,IM,I,X	O,I,IM,X,A	O,I,IM,X	O,I,IM,X,W	I,O,X	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

