

Certificate of Analysis

IARM CuH191-18

Copper Alloy / Hiduron 191 / UNS C72420

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	1.60 ± 0.03	C	0.004 ± 0.001	Co	0.002 ± 0.001	Cr	0.0013 ± 0.0007
Fe	0.96 ± 0.01	Mg	0.0059 ± 0.0005	Mn	3.79 ± 0.04	Ni	14.5 ± 0.3
P	0.003 ± 0.001	S	0.002 ± 0.001	Si	0.017 ± 0.004	Zn	0.0010 ± 0.0002

Indicative Values listed in ppm

Ag (20)	As (<100)	B (30)	Bi (20)	Cd (10)	Cu (79.6%)	H (<10)
Mo (<50)	N (<10)	Nb (<50)	O (<10)	Pb (30)	Sb (<50)	Sc (<50)
Se (30)	Sn (20)	Ti (<50)	V (<50)	W (<10)	Zr (<10)	

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.

	Al	C	Co	Cr	Fe	Mg	Mn	Ni	P	S	Si	Zn	Ag	As	B	Bi
1	1.532	0.0018	0.00038	0.0003	3.00	0.005	3.733	13.665	0.001	0.0004	0.0035	0.00089	0.001	0.0027	0.0009	0.0001
2	1.558	0.0027	0.00059	0.00084	0.934	0.0053	3.75	14.02	0.0018	0.0004	0.0113	0.001	0.001	0.01	0.003	0.0003
3	1.575	0.003	0.0007	0.00097	0.95	0.0057	3.75	14.022	0.003	0.0006	0.01317	0.001	0.0016	<0.001	0.003	0.003
4	1.58	0.00317	0.0018	0.0015	0.96	0.006	3.757	14.48	0.003	0.0007	0.016	0.001	0.0031	<0.005	0.0032	0.005
5	1.58	0.0036	0.002	0.0019	0.96	0.006	3.764	14.4937	0.00405	0.00093	0.016	0.001	0.0041		0.00392	<0.001
6	1.5904	0.005	0.00398	0.002	0.966	0.0062	3.8037	14.60	0.0045	0.002	0.017	0.00141				<0.005
7	1.612	0.0065			0.9673	0.00623	3.806	14.63		0.004	0.0178					
8	1.63				0.975	0.0068	3.8458	14.63		0.00446	0.018					
9	1.6498				0.976		3.857	14.653			0.02					
10	1.659				0.976		3.8664	14.69			0.025					
11					0.9784			14.81			0.0276					
12					1.01			14.86								
13								15.5022								
14																
15																
Mean	1.6	0.004	0.002	0.0013	0.96	0.0059	3.79	14.5	0.003	0.002	0.017	0.001	0.002	0.010	0.003	0.002
STDV.	0.04	0.002	0.001	0.0007	0.02	0.0006	0.05	0.5	0.001	0.002	0.006	0.0002	0.001	0.005	0.001	0.002
Certified	1.60	0.004	0.002	0.0013	0.96	0.0059	3.79	14.5	0.003	0.002	0.017	0.0010	(0.002)	(<0.01)	(0.003)	(0.002)
U _{CRM}	0.03	0.001	0.001	0.0007	0.01	0.0005	0.04	0.3	0.001	0.001	0.004	0.0002				
Methods	G,I,O,X	O,C	I,O,IM	I,O,IM	G,I,O,X	I,O,X,IM	G,I,O,IM,X	G,I,O,X	O,I,IM	C,I,O	G,I,O,IM,X	I,O,IM,X	G,I,O	G,O,IM	O,I,IM	O,I,IM

	Cd	Cu	H	Mo	N	Nb	O	Pb	Sb	Sc	Se	Sn	Ti	V	W	Zr
1	0.00003	79.033	0.0001	0.00013	0.0003	0.001	0.0001	0.00017	0.00008	<0.005	0.00253	0.00009	0.00031	0.00016	<0.001	0.00009
2	0.00018	79.0395	0.00027	0.005	0.001	<0.001	0.0004	0.00027	0.001		0.0028	0.00016	0.003	<0.001	<0.001	0.000297
3	0.001	79.10		<0.001	<0.0005	<0.001	0.001	0.004	0.004		0.003	0.001	<0.001	<0.001	<0.001	<0.001
4	0.00162	79.10		<0.005	<0.001	<0.005	<0.0005	0.0077	<0.001		0.004	0.001	<0.005	<0.005	<0.001	<0.001
5	<0.001	79.17			<0.001		<0.001	<0.001	<0.001		<0.005	0.0027				<0.005
6	<0.001	80.19					<0.001	<0.001	<0.005		<0.005	0.0037				
7	<0.005	80.6671						<0.005				0.0042				
8		80.70														
9																
10																
11																
12																
13																
14																
15																
Mean	0.00010	79.6			0.0010		0.0010	0.003	0.002		0.003	0.002				0.0002
STDV.	0.0007	0.8			0.0005		0.0005	0.004	0.002		0.001	0.002				0.0001
Reference	(0.001)	(79.6)	(<0.001)	(<0.005)	(<0.001)	(<0.005)	(<0.001)	(0.003)	(<0.005)	(<0.005)	(0.003)	(0.002)	(<0.005)	(<0.005)	(<0.001)	(<0.001)
Methods	O,I,IM	I,W,X	F	I,IM	F	O,I,IM	F	O,I,IM	G,O,I,IM	IM	G,O,I,IM	I,O,IM	I,IM	I,IM	IM	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

LECO Corporation	St. Joseph, MI	Laboratory Testing, Inc.	Hatfield, PA
AY Mc Donald Mfg. Co.	Dubuque, IA	Anderson Laboratories, Inc.	Greendale, WI
Colonial Metals Co.	Columbia, PA	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 by utilizing a variety of test methods under the scope of ISO 17025 or have demonstrated equivalent performance. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

IARM 226A IARM 267A IARM 84B IARM 87B LECO 502-403 MBH 34X NS3 C MBH 36X CN11 A MBH 36X CN13 A MBH 36X CN21 A NIST 875

Homogeneity and Uncertainty

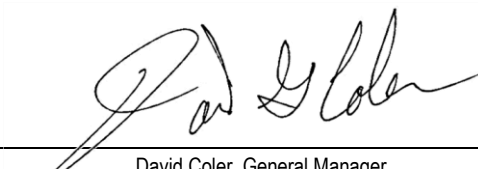
"Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental XRF results 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.


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 Analytical Reference Materials International

