

Analytical Reference Materials International



Certificate of Analysis Certified Reference Material

Grade: **CDA 110 / UNS C11000**

Part Number (Q.A. NO.): **IARM 70C**

Certificate Date: **07/18/2017**

Certificate No.: **70C-07182017-IARM-F**

Revision Date: **10/11/2017**

Interpretation of Data

- Certified values listed below reflect analysis results submitted by qualified analytical laboratories using a combination of methods and instrumentation that emulate actual methods and instrumental techniques currently utilized in the analytical community and are reported as % wt. unless otherwise noted.
- Any data reported and enclosed by a **parentheses ()** is a **"best estimate"** and is **NOT CERTIFIED**. This data could not be quantified sufficiently for certification. It was however, reported by enough laboratories to be considered as potentially present in the matrix of the material being examined.
- The "Inter laboratory Analysis Program" (ILAP) utilized in the establishment of the data are an ongoing program with permanent membership. Certain elements may be selected by a consensus of the members for more extensive testing. Therefore the data in **brackets []** indicates **further testing is in process**.
Chips are not certified for Oxygen analysis.
- The **"±Estimated Uncertainty"** is enclosed by a **parentheses ()** below the individual **element's concentration** and is based on a Confidence Interval at 95%. Included in this estimated uncertainty, are the combined effects of method imprecision, material inhomogeneity, and any bias between methods.

Important: A "User Registration Card" accompanies all shipments. This card should be completed immediately upon receipt of materials with the appropriate user information. This is the only way in which ARMI can guarantee customer updates or possible data modifications!

<u>Aluminum</u>	<u>Antimony</u>	<u>Arsenic</u>	<u>Beryllium</u>	<u>Bismuth</u>	<u>Boron</u>	<u>Cadmium</u>	<u>Carbon</u>	<u>Chromium</u>
0.0014 (0.0009)	(0.003)	0.0009 (0.0007)	(<0.002)	(0.002)	(0.0004)	(0.0008)	0.002 (0.001)	(0.0002)
<u>Cobalt</u>	<u>Copper</u>	<u>Germanium</u>	<u>Indium</u>	<u>Iron</u>	<u>Lead</u>	<u>Magnesium</u>	<u>Manganese</u>	<u>Nickel</u>
0.0014 (0.0009)	99.94 (0.04)	(<0.0002)	(<0.0001)	0.0016 (0.0009)	0.0013 (0.0008)	(0.0003)	(0.0002)	(0.0004)
<u>Niobium</u>	<u>Nitrogen</u>	<u>Oxygen</u>	<u>Phosphorus</u>	<u>Selenium</u>	<u>Silicon</u>	<u>Silver</u>	<u>Sulfur</u>	<u>Tellurium</u>
(0.004)	(<0.008)	(0.002)	0.0014 (0.0007)	(0.001)	0.0006 (0.0003)	0.0011 (0.0008)	0.0008 (0.0002)	(0.001)
<u>Tin</u>	<u>Zinc</u>	<u>Zirconium</u>						
0.0005 (0.0002)	(0.002)	(0.001)						

The laboratories participating in the "Inter-Laboratory Analysis Program" (ILAP) and certification of this material are as follows:

Anderson Laboratories, Inc. - Greendale, WI	Laboratorio Prove Materiali S. Marco srl - Schio, Italy
Colonial Metals Co. - Columbia, PA	Laboratory Testing, Inc. - Hatfield, PA
Concast Metal Products Co. - Mars, PA	Northern Analytical Laboratory, Inc. - Londonderry, NH
Davis Alloys Manufacturing, LLC - Sharpsville, PA	Revere Copper Products - Rome, NY
Exova - Gary, IN	revierlabor GmbH - Essen, Germany
Ingot Metal Co. Ltd. - Weston, ON	

Traceability: All members of the "Inter-Laboratory Analysis Program" (ILAP) listed above validate test methods and instrument performance utilizing SRMs produced by the National Institute of Standards and Technology, (NIST) as well as other CRMs and RMs produced by recognized Certifying Bodies from around the world. The specific SRMs, CRMs, and RMs applicable to the material covered by this certificate are:

ALPHA AR147	CTIF 4583	IARM 84A	LECO 501-147	MF II/2A	MF VI	NIST 3112A	NIST 3150	OUTOK 171
ALPHA AR644	CTIF 4873	IARM 84B	LECO 501-148	MF II/3	MF VII	NIST 3113	NIST 3151	OUTOK 173
ALPHA AR668	ELTRA 91000-1	KAMET 3597	LECO 501-644	MF II/4	MF VIII	NIST 3120A	NIST 3156	OUTOK 174
ALPHA AR881	EN 284-1	KAMET 3598	LECO 501-646	MF II/5	MF XI	NIST 3124A	NIST 3161A	OUTOK 183
BAM 222	ERM EB385	KAMET 3599	LECO 501-991	MF II/6	NIST 3101A	NIST 3128	NIST 3168A	RC 12/12
BCS 376	IARM 158C	KAMET 3600	LECO 502-992RC 11/4	MF II/7	NIST 3102A	NIST 3131A	NIST 3169	RC 32/29
BS 110	IARM 70A	KAMET 3601	MBH 178700	MF II/8	NIST 3103A	NIST 3132	NIST 498	RC 36/28
BS 110A	IARM 70B	KAMET 3602	MBH 39X17870AD	MF II/9	NIST 3105A	NIST 3136	NIST C1251	
BS 863B	IARM 71A	KAMET 3603	MF II/10	MF III	NIST 3106	NIST 3137	NIST C1252	
CRM 074A	IARM 78B	KAMET 3604	MF II/1-2	MF IV	NIST 3107	NIST 3139A	NIST C1253A	
CRM 075A	IARM 80C	KAMET 3605	MF II/2-2	MF V	NIST 3108	NIST 3149	NR361	

A specific line of traceability is established to NIST and other Certifying Bodies for those elements that are noted as "Certified Values" on the Certificates of Analyses referenced above.

See Reverse Side for Statistical Data and Additional Information Regarding this Material.

276 Abby Road • Manchester, NH • Telephone (603) 935-4100 • FAX (603) 935-4101

The following data and accompanying statements represent all pertinent information reported in the ILAP as it applies to the chemical characterization of this material as of 10/11/2017.

70C	Al	Sb	As	Be	Bi	B	Cd	C	Cr	Co	Cu	Ge	In	Fe	Pb	Mg
1	0.000001	0.0002	0.00003	0.0002	0.000012	0.0004	0.0001	0.0007	0.000004	0.000002	99.845	0.0002	<0.00001	0.000335	0.000049	0.000005
2	0.0008	0.0002	0.0001	<0.000001	0.0002	0.0004	0.001	0.0009	0.0001	0.0003	99.9	<0.000001	<0.0001	0.0005	0.0002	0.0001
3	0.0008	0.0004	0.0001	<0.0001	0.0007	<0.000001	0.0013	0.0011	0.0001	0.0007	99.91	<0.0001		0.00072	0.0007	0.00018
4	0.001	0.0052	0.0003	<0.0001	0.0009	<0.0005	<0.00001	0.0016	0.0002	0.002	99.92			0.0012	0.001	0.0002
5	0.0011	0.0098	0.0008	<0.002	0.0021		<0.0001	0.0027	0.0005	0.0024	99.96			0.0016	0.0019	0.001
6	0.0015	<0.000001	0.001		0.0049		<0.0001	0.003	<0.0001	0.003	99.9677			0.0017	0.002	<0.0001
7	0.0016	<0.0001	0.0018		<0.00001		<0.002		<0.001		99.9819			0.0018	0.003	<0.0002
8	0.0043	<0.010	0.003						<0.0010		99.9963			0.0046		<0.003
9									<0.003							
10									<0.005							
11																
12																
13																
14																
15																
Mean	0.0014	0.003	0.0009	0.0002	0.001	0.0004	0.0008	0.002	0.0002	0.0014	99.94	0.0002		0.0016	0.0013	0.0003
STDV.	0.0013	0.004	0.0010		0.002		0.0006	0.001	0.0002	0.0012	0.05			0.0014	0.0011	0.0004
Certified	0.0014	(0.003)	0.0009	(<0.002)	(0.002)	(0.0004)	(0.0008)	0.002	(0.0002)	0.0014	99.94	(<0.0002)	(<0.0001)	0.0016	0.0013	(0.0003)
95% C.I.	0.0009		0.0007							0.0009	0.04			0.0009	0.0008	
Methods	X,O,I,G	O,IM,I,G	X,O,IM,I,G	O,IM,G	O,IM,I,G	O,I,G	O,IM,I,G	O,C	X,O,I,G	X,O,IM,I,G	W,O	IM,I,G	I,G	X,O,I,G	X,O,IM,G	O,I,G

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

70C	Mn	Ni	Nb	N	O	P	Se	Si	Ag	S	Te	Sn	Zn	Zr
1	0.000007	0.000016	0.0006	0.0004	0.0001	0.00005	0.0007	0.000006	0.0003	0.0005	0.0001	0.0001	0.000022	0.0001
2	0.0001	0.0003	0.001	0.0009	0.0002	0.0002	0.0008	0.0003	0.0004	0.0006	0.0001	0.00037	0.0002	0.001
3	0.0001	0.0003	0.0014	0.0079	0.0003	0.0008	0.0024	0.0005	0.00042	0.0006	0.0005	0.0004	0.0003	0.0022
4	0.0004	0.0006	0.012	<0.0005	0.0005	0.0017	<0.00001	0.0006	0.0006	0.0007	0.0016	0.0005	0.0006	<0.000001
5	<0.0005	0.0008	<0.000001	<0.0005	0.0006	0.0018	<0.0001	0.001	0.0011	0.0007	0.0025	0.0007	0.0008	<0.0001
6	<0.002	<0.0001	<0.0001		0.0044	0.0025		0.0012	0.0016	0.00071	<0.00001	0.0007	0.0107	<0.0001
7	<0.005	<0.0003			0.0087	0.0026			0.003	0.000795	<0.005		<0.0001	<0.0001
8	<0.005	<0.005								0.0009			<0.002	
9		<0.005								0.0012			<0.005	
10		<0.01								0.0012			<0.01	
11										0.0013				
12														
13														
14														
15														
Mean	0.0002	0.000403	0.004	0.003	0.002	0.0014	0.001	0.0006	0.0011	0.0008	0.001	0.0005	0.002	0.001
STDV.	0.0002	0.000303	0.006	0.004	0.003	0.0010	0.001	0.0004	0.0010	0.0003	0.001	0.0002	0.004	0.001
Certified	(0.0002)	(0.0004)	(0.004)	(<0.008)	(0.002)	0.0014	(0.001)	0.0006	0.0011	0.0008	(0.001)	0.0005	(0.002)	(0.001)
95% C.I.						0.0007		0.0003	0.0008	0.0002		0.0002		
Methods	X,O,I,G	X,O,I,G	O,I,G	F	F	X,O,I,G	O,IM,G	O,I,G	O,IM,G	O,I,G,C	O,IM,G	X,O,IM,I,G	X,O,I,G	O,IM,I,G

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

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1992 list the following:

Certifying Body: Any technically competent body (organization or firm, public or private) that issues a reference material certificate, which provides the information, detailed in ISO Guide 31. The only generally accepted certifying body in the United States for primary standards - Standard Reference Materials (SRM) is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD. All other certifying bodies in the United States produce Reference Materials (RM) or Certified Reference Materials (CRM).

Reference Material (RM): Material or substance one or more of whose property values are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): Reference material, accompanied by a certificate, one or more of whose property values are certified by a procedure, which establishes its traceability to an accurate realization of the unit in which the property values are expressed, and for which each certified value is accompanied by an uncertainty at a stated level of confidence.


Inter-Laboratory Analysis Program (ILAP): Although ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", it is also a well thought out and logical plan for conducting an inter laboratory program involving multiple techniques. Therefore, the planning, conducting, analyzing, protocol, and treatment of data resulting from this inter laboratory program were performed utilizing the guidelines established in ASTM E691-87.

Methods of Analysis: In view of the fact, that the "Inter Laboratory Analysis Program" entails a wide variety of materials, no single analytical method would provide optimum data results. Therefore, the methods utilized were a combination of ASTM Standard Methods for classical wet chemistry, ICP, AA, Optical Emission, and X-Ray spectrometric methods. The determinations for Carbon, Sulfur, Nitrogen, and Oxygen are the result of combustion and OE instrument procedures.

Expiration of Certification: The certification of this IARM is valid indefinitely, within the uncertainty specified, provided the IARM is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the IARM is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.

Instructions for Use: The test surface is the side opposite to the labeled surface, which includes the IARM number. 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. When not in use, the material should be stored in a cool, dry location. This material was tested using both the solid disks and chips prepared from the disks. The certified values are considered representative of the overall average composition of the material. Chips are not to be used for Oxygen analysis.

Selection of Materials: A "batch" or "series" is defined as a single bar of one continuous length and heat. The majority of materials are in wrought condition; other methods of manufacture are utilized as a less desirable resort. ILAP samples are taken by removing a section, a minimum of, every one-twelfth of total length from the entire bar. A portion of the section is converted to chips and thin (pin) disk for analysis by classical wet chemistry, ICP, AA, and combustion procedures, and the balance remains as a thick disk for OES and X-Ray analysis. This systematic sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data. This method of homogeneity testing is in accordance with ISO Guide 34, regarding the systematic selection and testing of a representative number of units for the assessment of homogeneity.


 David Coler, General Manager
 Analytical Reference Materials International



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