

Analytical Reference Materials International

Certificate of Analysis Certified Reference Material



Grade: CDA 964 / UNS C96400

Part Number (Q.A. NO.): IARM 236A

Certificate Date: 05/20/2002

Certificate No.: 236A-05202002-IARM-F

Revision Date: 11/08/2007

Interpretation of Data

1. 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.
2. 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.
3. 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**.
4. 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> 0.003 (0.001)	<u>Antimony</u> <0.005	<u>Bismuth</u> 0.003 (0.001)	<u>Boron</u> <0.007	<u>Carbon</u> 0.010 (0.002)	<u>Cobalt</u> 0.004 (0.002)	<u>Chromium</u> 0.002 (0.001)
<u>Copper</u> 66.7 (0.2)	<u>Iron</u> 0.91 (0.02)	<u>Manganese</u> 1.04 (0.02)	<u>Nickel</u> 30.0 (0.1)	<u>Nitrogen</u> 0.0002 (0.0001)	<u>Niobium</u> 0.92 (0.03)	<u>Oxygen</u> 0.002 (0.001)
<u>Phosphorus</u> 0.003 (0.001)	<u>Lead</u> 0.004 (0.002)	<u>Sulfur</u> 0.003 (0.001)	<u>Silicon</u> 0.19 (0.01)	<u>Tin</u> 0.005 (0.002)	<u>Titanium</u> <0.005	<u>Zinc</u> 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
Colonial Metals Co. - Columbia, PA
Gamma Foundries Co. - Richmond Hill, ON
MetalTek International, Inc. - Waukesha, WI
Ruukki Production - Raaha, Finland
Special Metals IncoTest - Hereford, UK
Spectrochemical Laboratories - Pittsburgh, PA

Bodycote Materials Testing - Chicago, IL
Concast Metal Products Co. - Mars, PA
Laboratory Testing, Inc. - Hatfield, PA
NSL Analytical Services - Cleveland, OH
Sipi-Metals Corp - Chicago, IL
Laboratory Testing, Inc. - Hatfield, PA

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: NIST 362, LECO 501-550, NIST 111G, 1276, BNF 50X31, 52X54, MBH 11224, EU 097-01, AR 673, TH 1045, JSS S5-6A, LECO 501-550, HAS 412B, 413B, 418A, R 6957, 6958, BCS 462-1, 351, LECO 501-503, 501-147, 501-102, 501-551, 501-553, NIST 3101A, 3102A, 3103A, 3105A, 3106, 3107, 3108, 3112A, 3128, 3131A, 3134, 3137, 3139A, 3150, 3151, 3156, 3161A, 3162A, 3168A, 3169A, 2159, 1276A, BCS 304/1, IARM 202A, AR 512, LECO 501-503, 501-553, 501-644, NIST 1276, LECO 502-148, 501-550, NIST 1276A, 131F, BAM 222, BCS 180/2, 363, IARM 85A, 85B, MBH 178700, LECO 501-551, NIST 1115, 1116, 1117, C1248, 3101A, 3102A, 3106, 3112A, 3113, 3128, 3132, 3139A, 3154, 3160, 3161A, 3168A, CTIF 3011G, BS 715A, 0NIST 1121, 164A, 62D, 158A, 1276, 63C, 1122, IARM 91B, 81A, OULRICH RC 38/5, IARM 84A, SUS RC38/1, LECO 501-550, 502-148, NIST 1276A, MBH CN9-F, IMN NB1, NB2, NB3, NB4, NB5, BAM 376, BS 706A, 715A, C715A, RC11/2, CTIF 4873, WILLAN CN/3E, CN/5F, IARM 84A, 85A, C62.14, C62.15, CN4E, CN5E, CN5F, BS 715A, 715.C37, 715.C39

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.

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 11/08/2007.

236A	Ag	Al	As	Be	Bi	C	Co	Cr	Cu	Fe	Mn	Nb	Ni	P	Pb
1	<0.001	0.002	<0.001	<0.001	0.0001	0.0090	0.0020	0.0012	66.60	0.927	1.0374	0.9373	30.2759	0.0016	0.0008
2	<0.001	0.004	<0.005	<0.0001	0.006	0.0096	0.007	0.0025	66.40	0.915	1.060	0.98	29.90	0.0030	0.0006
3	0.0006	0.0029	0.0033	<0.001	0.0001	0.0147	0.005	0.002	66.90	0.90	1.04	0.926	29.99	0.004	0.0027
4	<0.001	0.001	<0.001	<0.003	0.0047	0.0078	0.0020	0.0016	66.907	0.9567	1.095	0.885	29.923	0.0023	0.0008
5	<0.0005	0.0051	<0.0005	0.001	0.003	0.004	0.0055	0.0018	66.82	0.892	1.031	0.94	30.078	0.004	0.0095
6	0.002	0.004	0.03	0.041	0.001	0.009	0.0025	0.0012	66.91	0.915	1.09	0.875	29.80	0.0041	0.009
7		0.0047	<0.0001		0.0049	0.011	0.003	0.001	66.49	0.93	1.06	0.93	30.00	0.005	0.0028
8		0.0017	0.0010		0.0012	0.014	0.007	0.004	66.90	0.93	1.04	0.9201	30.12	0.0054	0.004
9		0.0045			0.0041	0.0096	0.010	0.0030	66.187	0.86	1.004		30.10	0.0019	0.0075
10					0.0047		0.0054	0.0036	66.925	0.880	1.012		30.018	0.0030	0.0050
11					0.0023		0.0010	0.0010		0.894	1.034		29.71	0.0040	0.00195
12							0.00074			0.980	1.079		29.57	0.0029	
13										0.857	1.035		30.391		
14										0.938	0.99166		30.0120		
15										0.9370					
Mean	0.0013	0.0033	0.0114	0.0210	0.0029	0.0099	0.0043	0.0021	66.7039	0.9141	1.0435	0.9242	29.9920	0.0034	0.0041
STDV.	0.0010	0.0015	0.0161	0.0283	0.0021	0.0031	0.0028	0.0011	0.2665	0.0342	0.0307	0.0328	0.2120	0.0012	0.0033
Certified		0.003			0.003	0.010	0.004	0.002	66.7	0.91	1.04	0.92	30.0	0.003	0.004
95% C.I.		0.001			0.001	0.002	0.002	0.001	0.2	0.02	0.02	0.03	0.1	0.001	0.002
Methods		X,I,O			X,H,I,O	C,O	X,I,O	X,I,O	X,W,A,I	X,A,I,O	X,A,I,O	X,I,O	X,W,I,O	X,I,O	X,D,H,A,I,O

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G = GDMS, H = Hollow Cathode OE

236A	S	Sb	Se	Si	Sn	Zn	Mg	Mo	N	O	Ti	Te	Zr	B	Cd
1	0.0005	0.004	<0.001	0.1956	0.0034	0.0029	<0.001	0.003	0.0004	0.0021	0.0002	<0.001	0.007	0.007	<0.001
2	0.0021	0.005	<0.001	0.203	0.0050	0.0023	<0.001	<0.0001	0.00002	0.0011	<0.001	0.0030	<0.010	0.0053	<0.0001
3	0.0032	0.003	<0.001	0.189	0.0010	0.0012	<0.0001	0.0035	0.0002	0.0011	0.002	<0.001	<0.0001	0.006	<0.001
4	0.0036	0.0017	<0.0009	0.1747	0.0041	0.0022	<0.001		0.0001	0.0018	0.0043	<0.003	<0.001		<0.0001
5	0.001	0.00345		0.209	0.0015	0.0018	<0.002		0.0002	0.0009			<0.001		<0.002
6	0.0007			0.204	0.0018	0.0022	<0.0007		0.0001	0.0030					0.0002
7	0.0045			0.19	0.009	0.0014	0.005								
8	0.00684			0.183	0.006		<0.0001								
9	0.0056			0.18	0.005		0.0010								
10	0.006			0.188	0.0053										
11	0.0021			0.195	0.0096										
12	0.0020			0.216	0.0106										
13	0.00177			0.1939	0.00345										
14				0.1864											
				0.193											
Mean	0.0031	0.0034		0.1934	0.0051	0.0020	0.0030	0.0033	0.0002	0.0017	0.0022	0.0030	0.0070	0.0061	0.0002
STDV.	0.0021	0.0012		0.0111	0.0031	0.0006	0.0028	0.0004	0.0001	0.0008	0.0021			0.0009	
Certified	0.003	<0.005		0.19	0.005	0.002			0.0002	0.002	<0.001			<0.007	
95% C.I.	0.001			0.01	0.002	0.001			0.0001	0.001					
Methods	X,C,I,O	I,O		X,I,O	X,H,A,I,O	H,I,O			F	F				D,I	

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, D = DC Arc, O = OE, X = XRF, G = GDMS, H = Hollow Cathode OE

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.

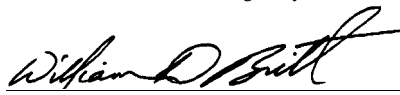
Inter-Laboratory Analysis Program (ILAP): Although ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", it is also a well thought out and logical plan for conducting an inter-laboratory program involving multiple techniques. Therefore, the planning, 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 to be representative of the overall average composition of the material. Chips are not intended 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.

Certified by: 
 William D. Britt, President & General Manager
 Analytical Reference Materials International Corporation

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