Analytical Reference Materials International

Certificate of Analysis
Certified Reference Material

Grade: **NIT 135M / UNS K24065**

Part Number (Q.A. NO.): **IARM 305A**

Certificate Date: **09/13/2007** Certificate No.: **305A-09132007-IARM-F** Revision Date: **05/11/2012**

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!

Aluminum	Antimony	Arsenic	Boron	Calcium	Carbon	Chromium	Cobalt	Copper
1.09	0.005	0.005	0.0004	0.0003	0.401	1.62	0.034	0.098
(0.02)	(0.001)	(0.001)	(0.0001)	(0.0001)	(0.002)	(0.01)	(0.001)	(0.001)
Lead	**Magnesium**	**Manganese**	**Molybdenum**	**Nickel**	**Niobium**	**Nitrogen**	**Oxygen**	**Phosphorus**
(0.001)	(0.0005)	0.61	0.41	0.142	0.003	0.0044	0.0008	0.005
		(0.01)	(0.004)	(0.001)	(0.0004)	(0.0001)	(0.0003)	(0.001)
Sulfur	**Silicon**	**Tantalum**	**Tin**	**Titanium**	**Tungsten**	**Vanadium**	**Zinc**	**Zirconium**
0.0009	0.38	(0.003)	0.006	0.0034	0.011	0.012	(0.002)	0.0013
(0.0003)	(0.004)		(0.001)	(0.0003)	(0.002)	(0.0005)		(0.0003)

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

Anderson Laboratories, Inc. - Greendale, WI
ArcelorMittal Indiana Harbor - East Chicago, IN
Crucible Industries - Syracuse, NY
Essar Steel Algoma, Inc. - Sault Ste. Marie, ON
Exova - Los Angeles, CA
Exova - Portland, OR
Keywell / Vac Air Alloys Division - Frewsburg, NY
Laboratory Testing, Inc. - Hatfield, PA
Latrobe Specialty Steel Co. - Latrobe, PA
Leco Corporation - St. Joseph, MI
MSI Testing & Engineering, Inc. - Melrose Park, IL
The Timken Company - Canton, OH
TMK IPSCO - Koppel, 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: **SUS RE12/19, INOX, C17, D8, CSN 2-1, CSN-4, NIST 12H, 337A, 2166, 1262B, 1263A, 1761, 1762, 1763, 1764, 1765, 1766, 1767, IARM 165A, 167A, 171A, BS 11B, 12B, 13B, 14B, 68A, LECO 501-991, 502-416, NIST 1163, 1261, 1263, IARM 30E, 35C, 46B, 152A, NIST 72F, 361, 1066, 3101A, 3102A, 3103A, 3106, 3107, 3109A, 3113, 3128, 3131A, 3137, 3155, 3161A, 3162A, 3163, 3168A, 3169, BS 2-1, LECO 501-643, ALPHA AR881, NIST 106, 106A, 337A, 1160, 1161, 1162, 1163, 1164, 1754, 1760, 1761, 1762, 1763, 1764, 1765, 1766, 1767, BAS 401/1, 402/1, 403/1, 404/1, 405/1, 406/1, 407/2, 408/1, 409/1, 410/2, JSS ST01, ST02, ST03, ST04, ST05, ST06, 168-4, 169-4, 170-4, 171-4, 172-4, 173-4, 174-4, 175-4, BS CA-1, CA-2, CA-3, CA-4, CA1A, CA3A, XAAS, XCCV, XCCS, LECO 501-510, 501-645, NIST 1163, 1164, 1166, 1249, 1285, BCS 345, 346, NIST 132B, 134A, 1157, 1282, BS 32C, IARM 35A, 35B, 35C, 35D, BS 68A, SUS B5, LECO 501-503, 501-504, 501-644, IARM 35A, 36A, 39A, CPI-4400 10M11, 100031, 100074, 100022, 10M553, 10M681, 10M691, LECO 501-506, 501-550, ALPHA AR 656, AR873, NIST 100B, 131F, 100B, 1762, 1763, 1764, 1765, NIST 1164, 1261, 1263, 1764, 1765, IARM 152B, BS 12B, 46A, 58E, 61D, 184A, 192, 4620, 4942, SS 406/1, 410/1, 459, CRM FE2/1, LECO 501-643, 501-677, 501-678, ALPHA AR881, AR1653, ALPHA AR875, LECO 501-503, NIST 152B, 1763, IARM 35D, 229A, NIT 135M.**

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.

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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 05/11/2012.

305A	Al	As	B	C	Co	Cr	Cu	Mn	Mo	N	Nb	Ni	O	P	Pb
1	1.14	0.0035	0.0004	0.410	0.035	1.60	0.100	0.610	0.400	0.0046	0.0036	0.1395	0.0004	0.0040	0.0012
2	1.117	0.004	0.0005	0.3981	0.035	1.629	0.0944	0.6206	0.4140	0.0047	0.003	0.140	0.00063	0.0065	0.00009
3	1.063	0.0055	0.0002	0.402	0.0337	1.630	0.100	0.616	0.416	0.00437	0.0028	0.1405	0.0007	0.0046	0.0022
4	1.0486	0.0033	0.0001	0.40854	0.0343	1.610	0.093	0.6160	0.411	0.0045	0.0034	0.1408	0.00044	0.0065	0.0003
5	1.079	0.0035	0.00056	0.3975	0.0345	1.638	0.0959	0.5828	0.418	0.00427	0.002	0.143	0.0012	0.0045	0.0009
6	1.054	0.006	0.0004	0.399	0.0331	1.61	0.099	0.617	0.427	0.0043	0.0031	0.140	0.0012	0.0038	
7	1.06	0.0056	0.00039	0.404	0.0327	1.628	0.101	0.628	0.419	0.00470	0.0023	0.143	0.00078	0.0030	
8	1.090	0.005	0.00052	0.400	0.034	1.577	0.100	0.602	0.4207	0.0043	0.0023	0.14165	0.00065	0.0045	
9	1.118	0.0052	0.00042	0.3981	0.033	1.630	0.0995	0.6234	0.407	0.0042	0.0032	0.144		0.0068	
10	1.106	0.0058	0.0004	0.396	0.033	1.593	0.096	0.589	0.417	0.0040	0.0022	0.140		0.0046	
11	1.146		0.0004	0.3976	0.033	1.610	0.099	0.637	0.406	0.0046	0.0029	0.142		0.006	
12	1.054		0.0006	0.400	0.0341	1.627	0.097	0.620	0.414	0.0040		0.143		0.0051	
13	1.079		0.0002	0.398		1.637	0.098	0.603	0.405	0.0044		0.1443		0.0048	
14	1.1081			0.4064			0.098	0.621	0.41355					0.0058	
15				0.397			0.0985	0.6128							
Mean	1.0902	0.0047	0.0004	0.4008	0.0338	1.6168	0.0980	0.6132	0.4134	0.0044	0.0028	0.1417	0.0008	0.0050	0.0009
STDV.	0.0327	0.0011	0.0001	0.0044	0.0008	0.0186	0.0023	0.0142	0.0071	0.0002	0.0005	0.0017	0.0003	0.0011	0.0008
Certified	**1.09**	**0.005**	**0.0004**	**0.401**	**0.034**	**1.62**	**0.098**	**0.61**	**0.41**	**0.0044**	**0.003**	**0.142**	**0.0008**	**0.005**	**(0.001)**
95% C.I.	**0.02**	**0.001**	**0.0001**	**0.002**	**0.001**	**0.01**	**0.001**	**0.01**	**0.004**	**0.0001**	**0.0004**	**0.001**	**0.0003**	**0.001**	
Methods	X,G,A,I,O	I,O	G,I,O	G,C,O	X,G,I,O	X,G,A,I,O	X,G,A,I,O	X,G,A,I,O	X,G,A,I,O	F,O	X,I,O	X,G,A,I,O	F	X,G,I,O	I,O

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

305A	S	Si	Sn	Ti	V	W	Bi	Ca	Cd	Mg	Sb	Se	Ta	Zn	Zr
1	0.0010	0.370	0.0049	0.0030	0.0124	0.015	<0.00003	0.0004		0.0007	0.0044	0.0039	0.0031	0.0013	0.0010
2	0.0003	0.3913	0.0100	0.0039	0.0114	0.0066	0.0001	0.0001		0.0009	0.0041	0.003	0.002	0.0014	0.0010
3	0.0015	0.393	0.0070	0.0040	0.0130	0.008	0.0093	0.00011		0.0003	0.0061	0.0044	0.0035	0.0021	0.0018
4	0.0016	0.3855	0.0050	0.0039	0.013	0.0114		0.0003		0.0001	0.003		0.0024	0.0011	0.0011
5	0.0015	0.3849	0.0070	0.0032	0.0130	0.010		0.0002		0.0007	0.0075			0.0016	0.0013
6	0.00084	0.385	0.0048	0.0040	0.0115	0.0102		0.0004			0.0058				0.0014
7	0.0008	0.381	0.0061	0.0036	0.011	0.0090					0.0050				0.0017
8	0.0017	0.394	0.0041	0.0033	0.013	0.0144									0.0014
9	0.0009	0.3760	0.0084	0.0032	0.0131										
10	0.0004	0.376	0.0056	0.0030	0.0127										
11	0.00040	0.392	0.007	0.0023	0.0131										
12	0.0003	0.381	0.0061	0.0031											
13		0.3816	0.0080	0.0031											
14		0.3781	0.0048												
Mean	0.0009	0.3835	0.0063	0.0034	0.0125	0.0106	0.0047	0.0003	#DIV/0!	0.0005	0.0051	0.0038	0.0028	0.0015	0.0013
STDV.	0.0005	0.0072	0.0017	0.0005	0.0008	0.0029	0.0065	0.0001	#DIV/0!	0.0003	0.0015	0.0007	0.0007	0.0004	0.0003
Certified	**0.0009**	**0.38**	**0.006**	**0.0034**	**0.012**	**0.011**		**0.0003**		**(0.0005)**	**0.005**		**(0.003)**	**(0.002)**	**0.0013**
95% C.I.	**0.0003**	**0.004**	**0.001**	**0.0003**	**0.0005**	**0.002**		**0.0001**			**0.001**				**0.0003**
Methods	G,C,O	X,G,A,I,O	X,G,I,O	X,G,I,O	X,G,I,O	G,I,O		I,O		I,O	X,I,O	O	I,O	I,O	X,I,O

Legend: W = Classical, C = Combustion, F = Fusion, A = AA or GFAA, I = ICP or DCP, 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 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.

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

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