

Analytical Reference Materials International



Certificate of Analysis Certified Reference Material

Grade: Alloy HR-120 / UNS N08120

Part Number (Q.A. NO.): IARM 282A

Certificate Date: 04/03/2017

Certificate No.: 282A-04032017-IARM-F

Revision Date: 10/10/2017

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.
Chips are not certified for Oxygen analysis.
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>	<u>Antimony</u>	<u>Arsenic</u>	<u>Bismuth</u>	<u>Boron</u>	<u>Calcium</u>	<u>Carbon</u>	<u>Chromium</u>	<u>Cobalt</u>
0.085 (0.005)	(0.0004)	(0.003)	(<0.0001)	0.005 (0.001)	(<0.003)	0.054 (0.001)	24.6 (0.1)	0.12 (0.008)
<u>Copper</u>	<u>Iron</u>	<u>Lanthanum</u>	<u>Lead</u>	<u>Magnesium</u>	<u>Manganese</u>	<u>Molybdenum</u>	<u>Nitrogen</u>	<u>Niobium</u>
0.0615 (0.0004)	35.7 (0.2)	(<0.01)	(0.001)	0.004 (0.001)	0.81 (0.01)	0.210 (0.005)	0.207 (0.003)	0.57 (0.02)
<u>Nickel</u>	<u>Oxygen</u>	<u>Phosphorus</u>	<u>Silicon</u>	<u>Silver</u>	<u>Sulfur</u>	<u>Tantalum</u>	<u>Tin</u>	<u>Titanium</u>
37.1 (0.1)	0.0023 (0.0006)	0.016 (0.001)	0.63 (0.01)	(0.0001)	0.0003 (0.0001)	(0.005)	0.003 (0.001)	0.019 (0.002)
<u>Tungsten</u>	<u>Vanadium</u>	<u>Zirconium</u>						
0.043 (0.005)	0.052 (0.003)	(0.002)						

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

Anderson Laboratories, Inc. - Greendale, WI	ATI Specialty Materials, Lockport - Lockport, NY
ATI Specialty Materials, Monroe - Monroe, NC	Dirats Laboratories - Westfield, MA
Exova - Los Angeles, CA	Exova - Portland, OR
Haynes International, Inc. - Kokomo, IN	IMR Test Labs - Lansing, NY
Laboratory Testing, Inc. - Hatfield, PA	Latrobe Specialty Metals - Latrobe, PA
Leco Corporation - St. Joseph, MI	PM Kalco, Inc - Wheatland, PA
Special Metals IncoTest - Hereford, UK	

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 AR1647	BS 825C	IARM 239A	IARM 67A	LECO 501-644	NIST 1186	NIST 3106	NIST 3169	NIST 865
ALPHA AR511	HAS 020A	IARM 2C	IARM 69A	LECO 501-674	NIST 1187	NIST 3107	NIST 339	NIST C1288
ALPHA AR663	HAS 317B	IARM 302A	IH 84977	LECO 501-992	NIST 1246	NIST 3109A	NIST 348	
ALPHA AR890	HAS 36A	IARM 4B	IHR5657	LECO 502-016	NIST 160A	NIST 3127A	NIST 348A	
BCS 351	IARM 157A	IARM 50B	LECO 501-449	LECO 502-072	NIST 160B	NIST 3128	NIST 361	
BCS 454/1	IARM 157B	IARM 51C	LECO 501-502	LECO 502-102	NIST 1763	NIST 3131A	NIST 362	
BCS 462/1	IARM 15B	IARM 53A	LECO 501-503	LECO 502-257	NIST 1765	NIST 3151	NIST 363	
BS 197A	IARM 18B	IARM 53D	LECO 501-551	MBH 24XWASP3D	NIST 3101A	NIST 3155	NIST 364	
BS 3B	IARM 21B	IARM 60B	LECO 501-643	MBH 28X7185J	NIST 3102A	NIST 3161A	NIST 367	

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 10/10/2017.

	Al	Sb	As	Bi	B	Ca	C	Cr	Co	Cu	Fe	La	Pb	Mg	Mn
1	0.0748	0.0003	0.0024	0.00001	0.0032	0.0003	0.052	24.33	0.0991	0.061	35.28	0.001	0.00004	0.0028	0.792
2	0.075	0.000301	0.0037	<0.000001	0.0037	0.0027	0.0522	24.442	0.1047	0.0611	35.48	0.009	0.000055	0.003	0.795
3	0.077	0.0005		<0.0001	0.00397	<0.0001	0.0523	24.455	0.108	0.0611	35.516		0.0022	0.0033	0.804
4	0.083			<0.0001	0.004		0.0529	24.49	0.11	0.0615	35.527		0.003	0.0039	0.806
5	0.083			<0.005	0.0044		0.0534	24.578	0.113	0.062	35.566		<0.0001	0.0044	0.8100
6	0.0852				0.005		0.0537	24.581	0.1190	0.062	35.626		<0.0005	0.005	0.817
7	0.0852				0.0053		0.054	24.5880	0.125	0.062	35.729		<0.001	0.0053	0.822
8	0.087				0.0053		0.0551	24.588	0.125		35.74		<0.005		0.8256
9	0.091				0.0056		0.0559	24.60	0.129		35.80				0.829
10	0.095				0.0059			24.6391	0.132		35.837				
11	0.097				0.0060			24.76	0.135		35.905				
12					0.0063						36.294				
13					0.0067						36.380				
14															
15															
Mean	0.085	0.0004	0.003	0.0000	0.005	0.002	0.054	24.6	0.118	0.0615	35.7	0.005	0.001	0.004	0.81
STDV.	0.007	0.0001	0.0009		0.001	0.002	0.001	0.1	0.01	0.0005	0.3	0.006	0.002	0.001	0.01
Certified	0.085	(0.0004)	(0.003)	(<0.0001)	0.005	(<0.003)	0.054	24.6	0.118	0.0615	35.7	(<0.01)	(0.001)	0.004	0.81
95% C.I.	0.005				0.001		0.001	0.1	0.008	0.0004	0.2			0.001	0.01
Methods	X,O,I,G	IM,H	IM,H	IM,I,H,A	O,I,G	O,I	C	X,W,O,I,G	X,O,I,G	X,O,I,G	X,W,O,I,G	O,I	O,IM,I,H,A	O,I	X,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

	Mo	N	Nb	Ni	O	P	Si	Ag	S	Ta	Sn	Ti	W	V	Zr
1	0.199	0.2010	0.52	36.82	0.00105	0.0134	0.597	0.000013	0.0001	0.0022	0.0013	0.0141	0.034	0.0429	0.0009
2	0.20	0.203	0.5329	36.85	0.0015	0.0136	0.603	0.00004	0.0001	0.003	0.0025	0.015	0.0375	0.046	0.002
3	0.2010	0.2035	0.538	37.003	0.0019	0.0138	0.615	0.0001	0.0002	0.005	0.0025	0.017	0.038	0.048	<0.0001
4	0.2039	0.206	0.541	37.057	0.00209	0.0146	0.616	<0.0002	0.0002	0.005	0.00293	0.018	0.042	0.049	<0.001
5	0.209	0.208	0.5560	37.08	0.0021	0.015	0.625	<0.005	0.000286	0.0088	0.0034	0.020	0.043	0.05	<0.001
6	0.209	0.210	0.556	37.151	0.0025	0.016	0.634		0.0005	<0.01	0.0036	0.020	0.044	0.0501	<0.002
7	0.210	0.2106	0.5724	37.218	0.0027	0.016	0.6369		0.00052	<0.01	0.0044	0.02	0.0472	0.051	
8	0.2113	0.211	0.587	37.231	0.0034	0.017	0.6382					0.02	0.049	0.051	
9	0.212	0.2121	0.594	37.250	0.0035	0.0173	0.64					0.0208	0.053	0.054	
10	0.2184		0.602	37.37		0.0174	0.645					0.022		0.054	
11	0.220		0.62	37.5687		0.0179	0.651					0.023		0.059	
12	0.224		0.627			0.0181								0.059	
13														0.062	
14															
15															
Mean	0.210	0.207	0.57	37.1	0.0023	0.016	0.63	0.0001	0.0003	0.005	0.0029	0.019	0.043	0.052	0.001
STDV.	0.008	0.004	0.04	0.2	0.0008	0.002	0.02	0.0000	0.0002	0.003	0.001	0.003	0.006	0.005	0.0008
Certified	0.210	0.207	0.57	37.1	0.0023	0.016	0.63	(0.0001)	0.0003	(0.005)	0.003	0.019	0.043	0.052	(0.002)
95% C.I.	0.005	0.003	0.02	0.1	0.0006	0.001	0.01		0.0001		0.001	0.002	0.005	0.003	
Methods	X,O,I,G	F	X,O,I,G	X,W,O,I	F	X,O,I,G	X,W,O,I	IM,I,H,A	X,O,C	X,O,IM,I	X,O,IM,H	X,O,I,G	X,O,I,G	X,O,I,G	X,O,IM,I

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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