

Analytical Reference Materials International

Certificate of Analysis Certified Reference Material



Grade: Alloy C-22 / UNS N06022

Part Number (Q.A. NO.): IARM 65C

Certificate Date: 10/14/2009

Certificate No.: 65C-10142009-IARM-F

Revision Date: 08/24/2017

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.
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 "**± Confidence Interval at 95%**" is enclosed by a **parentheses ()** below the individual element's concentration.

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>Boron</u>	<u>Carbon</u>	<u>Cobalt</u>	<u>Chromium</u>	<u>Copper</u>	<u>Iron</u>	<u>Magnesium</u>
0.18	0.001	0.0053	1.43	21.13	0.072	4.72	0.0024
(0.004)	(0.0005)	(0.0003)	(0.01)	(0.02)	(0.002)	(0.03)	(0.0003)
<u>Manganese</u>	<u>Molybdenum</u>	<u>Nitrogen</u>	<u>Niobium</u>	<u>Nickel</u>	<u>Oxygen</u>	<u>Phosphorus</u>	<u>Sulfur</u>
0.288	13.29	0.034	0.027	55.8	0.0014	0.0111	0.0006
(0.003)	(0.03)	(0.002)	(0.002)	(0.1)	(0.0003)	(0.0002)	(0.0001)
<u>Silicon</u>	<u>Tantalum</u>	<u>Tin</u>	<u>Titanium</u>	<u>Vanadium</u>	<u>Tungsten</u>	<u>Zirconium</u>	
0.048	(0.03)	(0.001)	0.0052	0.010	2.77	0.004	
(0.004)			(0.0002)	(0.002)	(0.02)	(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
ATI Allvac, Monroe - Monroe, NC
Exova - Riverside Park, Middlesbrough, UK
Huntington Alloys Corporation - Huntington, WV
Laboratory Testing, Inc. - Hatfield, PA
Special Metals IncoTest - Hereford, UK

ATI Allvac, Lockport - Lockport, NY
Exova - Portland, OR
Haynes International, Inc. - Kokomo, IN
Kalco Metals, Inc - Farrell, PA
Latrobe Specialty Steel Co. - Latrobe, PA
ThyssenKrupp VDM USA - Florham Park, NJ

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: IARM 65B, LECO 501-503, 502-257, BS H6A, ALPHA AR654, AR881, NIST 867, 3102A, 3106, 3107, 3127A, 3128, 3131A, 3151, 3161A, IH PT71, LECO 501-643, NIST 3101A, 3128, 3131A, 3137, 3155, 3169, MBH 215XHC1K, ALPHA AR669, AR881, HAS 276A, BCS 351, 454/1, 462/1, LECO 501-551, 502-102, IH R5657, BCS 310/1, 346, 461/1, HC 276, IH RR0211, LECO 501-644, 501-673, NIST 897, HAS 622B, LECO 502-102, ALPHA AR881, NIST 864, 867, IARM 56D, 65A, 65B, 68B, 100B, IARM 65A, 65B, BS H6A, CSN-4, ALV PT71, LECO 502-257, NIST 899C, BCS CRM-346, ICV-GFAA, IARM 65A, 66B, 66C, LECO 501-992, 502-102, 502-412BS H6, IARM 65A, BS H6A, ALPHA AR654, AR881.

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 08/24/2017.

65C	Al	B	C	Cr	Co	Cu	Fe	Mg	Mn	Mo	Ni	Nb	N	O	P	Si	S
1	0.181	0.0001	0.0055	21.17	1.44	0.070	4.74	0.0025	0.294	13.37	55.57	0.026	0.0326	0.0010	0.0117	0.046	0.0006
2	0.171	0.0012	0.0045	21.14	1.434	0.065	4.66	0.0028	0.289	13.28	56.18	0.030	0.0394	0.0017	0.0109	0.042	0.0008
3	0.178	0.0009	0.0057	21.17	1.437	0.071	4.675	0.0025	0.289	13.268	55.69	0.029	0.0378	0.0009	0.0110	0.048	0.0004
4	0.1772	0.0005	0.0056	21.133	1.468	0.076	4.74	0.0022	0.2829	13.256	56.03	0.0304	0.0364	0.0018	0.0109	0.0547	0.0006
5	0.186	0.0021	0.0056	21.175	1.44	0.0728	4.711	0.0019	0.289	13.35	55.75	0.022	0.0345	0.0016	0.0115	0.040	0.0008
6	0.1783	0.0024	0.0050	21.06	1.405	0.075	4.77	0.0022	0.283	13.34	55.69	0.0260	0.0327	0.0016	0.0113	0.0545	0.0007
7	0.186	0.0007	0.0050	21.13	1.430	0.075	4.78	0.0031	0.293	13.272	55.74	0.030	0.0333	0.0010	0.0114	0.0525	0.0006
8	0.178	0.0011	0.0056	21.10	1.409	0.066	4.79	0.0022	0.2848	13.309	55.70	0.020	0.0332	0.0016	0.0110	0.0454	0.0005
9	0.1900	0.0009	0.0051	21.114	1.446	0.0697	4.667		0.2910	13.267	56.01	0.027	0.0332	0.0011	0.0113	0.0483	0.0005
10	0.1894	0.0019	0.0052	21.127	1.436	0.0754	4.651		0.2863	13.259	56.04	0.0292	0.0332		0.0108	0.0526	0.0004
11	0.1925			21.151	1.433	0.076	4.717		0.292	13.230		0.0280	0.0364		0.0107		0.0008
12	0.1901			21.14	1.402	0.0723	4.736		0.2816			0.020	0.0309				0.0007
13				21.094								0.0286					
14																	
Mean	0.1831	0.0012	0.0053	21.131	1.432	0.0720	4.720	0.0024	0.2880	13.291	55.84	0.0266	0.0345	0.0014	0.0111	0.0484	0.0006
STDV.	0.0068	0.0007	0.0004	0.033	0.019	0.0038	0.048	0.0004	0.0042	0.045	0.21	0.0037	0.0025	0.0004	0.0003	0.0051	0.0001
Certified	0.18	0.001	0.0053	21.13	1.43	0.072	4.72	0.0024	0.288	13.29	55.8	0.027	0.034	0.0014	0.0111	0.048	0.0006
95% C.I.	0.004	0.0005	0.0003	0.02	0.01	0.002	0.03	0.0003	0.003	0.03	0.1	0.002	0.002	0.0003	0.0002	0.004	0.0001

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

65C	Ta	Ti	W	V	Sb	As	Bi	Ca	Hf	La	Pb	Re	Ag	Sn	Y	Zr
1	0.059	0.0056	2.81	0.0063	0.0003	0.0022	<0.0001	<0.001		<0.000001	<0.0005		0.0001	0.0010		0.0056
2	0.044	0.0060	2.73	0.011	0.0003	0.0006	0.000003	<0.0010			0.0066		0.0001	0.0008		0.003
3	0.009	0.0050	2.790	0.0116	0.0001	0.0008	0.00002	0.0007			0.00002		0.0001	0.0005		0.003
4	0.010	0.0050	2.730	0.015	0.0003		<0.0001				0.0036		0.0001	0.0009		0.0058
5	0.0547	0.0050	2.758	0.0092			<0.0001				0.00002			0.0004		0.0029
6	0.051	0.0051	2.795	0.012			<0.0001				<0.0001					0.0048
7	0.0123	0.0052	2.808	0.0074			<0.00001				<0.0001					0.0019
8	0.007	0.0050	2.76	0.0117							<0.0005					
9	0.0046	0.0050	2.81	0.008							<0.0001					
10		0.0052	2.742	0.0099												
11			2.755													
12			2.766													
13			2.789													
14																
Mean	0.0280	0.0052	2.772	0.0102	0.0002	0.0012							0.0001	0.0007		0.0039
STDV.	0.0234	0.0003	0.030	0.0026	0.0001	0.0009							0.0000	0.0003		0.0015
Certified	(0.03)	0.0052	2.77	0.010	(0.0002)								(0.0001)	(0.001)		0.004

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

The International Standards Organization (ISO) definitions, expressed in ISO Guide 30-1981-(E) list the following:

Certifying Body: A technically competent body (organization or firm, public or private) that issues a Reference Material Certificate. The only generally accepted certifying body in the United States is the U. S. Department of Commerce, National Institute of Standards & Technology, (NIST), Gaithersburg, MD.

Reference Material (RM): A material or substance with one or more properties which are sufficiently well established to be used for calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Certified Reference Material (CRM): A reference material with one or more properties whose values are certified by a technically valid procedure accompanied by or traceable to a certificate or other documentation, which is issued by a Certifying Body.

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 instrument procedures.

Selection of Materials: A "batch" or "series" is defined as a single bar of one continuous length. The majority of materials are in wrought condition. Other methods of manufacture are utilized as a last resort, only in the case of those materials being unavailable in wrought condition. "Batch" samples are taken by removing a one-inch cross section for every thirteen inches of total length from the entire bar. Twenty-five percent of the one inch cross section is converted to chips for analysis by classical wet chemistry, ICP, AA, and combustion procedures and seventy-five percent remains in a solid disk form for OES and X-Ray analysis where applicable. Each member of the ILAP is furnished both a solid sample and the corresponding supply of chips from a specific location on the batch bar. This massive sampling procedure results in the homogeneity being reflected as a product of the overall statistics and certified data.

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

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