

Analytical Reference Materials International

Certificate of Analysis Certified Reference Material



Grade: Alloy K500 / UNS N05500

Part Number (Q.A. NO.): IARM 52C

Certificate Date: 08/13/2008

Certificate No.: 52C-08132008-IARM-F

Revision Date: 02/05/2009

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> 2.98 (0.03)	<u>Boron</u> (0.001)	<u>Carbon</u> 0.153 (0.003)	<u>Cobalt</u> 0.005 (0.001)	<u>Chromium</u> 0.046 (0.003)	<u>Copper</u> 30.6 (0.1)	<u>Iron</u> 1.04 (0.02)	<u>Lead</u> 0.0003 (0.0001)
<u>Magnesium</u> 0.0021 (0.0002)	<u>Manganese</u> 0.89 (0.01)	<u>Molybdenum</u> 0.011 (0.002)	<u>Nitrogen</u> (0.0002)	<u>Niobium</u> 0.003 (0.0005)	<u>Nickel</u> (63.6)	<u>Oxygen</u> (0.001)	<u>Phosphorus</u> 0.009 (0.0005)
<u>Silicon</u> 0.14 (0.01)	<u>Sulfur</u> 0.002 (0.0004)	<u>Tantalum</u>	<u>Tin</u> (0.001)	<u>Titanium</u> 0.55 (0.01)	<u>Tungsten</u> (0.01)	<u>Vanadium</u> 0.003 (0.001)	<u>Zirconium</u> 0.051 (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
Colonial Metals Co. - Columbia, PA
Huntington Alloys Corporation - Huntington, WV
Laboratory Testing, Inc. - Hatfield, PA
MetalTek International, Inc. - Waukesha, WI

ATI Allvac, Lockport - Lockport, NY
Bodycote Testing - Portland, OR
Haynes International, Inc. - Kokomo, IN
Kalco Metals, Inc - Farrell, PA
Latrobe Specialty Steel Co. - Latrobe, 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: IARM 52B, BS 400B, 500C, 500D, CT C35, RV 1361, LECO 501-503, 501-504, 501-643, 501-674, IARM 52A, LECO 501-550, ALPHA AR873, NIST 162, 1248, 3101A, 3102A, 3103A, 3106, 3107, 3109A, 3112A, 3113, 3128, 3131A, 3137, 3139A, 3151, 3155, 3161A, 3163, 3165, 3169A, BS 2-1, MBH 212X40050, LECO 501-643, 762-747, HAS 500G, BCS 351, 454/1, 462/1, LECO 501-551, 502-102, R5657, HAS 500G, SYN QXFA, LECO 501-510, ALPHA AR645, AR881, IARM 51B, 51C, 52B, LECO 501-503, 502-456, IARM 52A, 52B, 202A, LECO 501-503, 501-551, BS 400-2, LECO 501-502, ALPHA AR668, AR872, IARM 51C, NIST 867, 3109A, 3128, 3131A, 3161A, BS 500D, LECO 501-643, 762-747, IARM 52B, BS500B, ALPHA AR669, LECO 762-747.

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 02/05/2009.

52C	Al	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	N	Nb	Ni	O	P
1	2.99	0.0006	0.1490	0.0047	0.048	30.42	1.07	0.0021	0.87	0.013	0.0001	0.0038	63.83	0.00042	0.00853
2	3.013	0.0021	0.148	0.0055	0.051	30.382	1.082	0.00195	0.8915	0.0149	0.0001	0.0034	63.727	0.0008	0.010
3	3.022	0.0016	0.1537	0.0054	0.0544	30.62	1.020	0.0019	0.881	0.011	0.0004	0.0025	63.67	0.0023	0.00805
4	2.954	0.0006	0.153	0.0046	0.0359	30.49	0.9905	0.0020	0.912	0.0090	0.00018	0.0025	63.52	0.0005	0.00875
5	3.02	0.0004	0.158	0.004	0.048	30.499	1.003	0.0026	0.8597	0.010	0.0003	0.0032	63.48	0.0020	0.0088
6	3.01	0.0003	0.1521	0.0057	0.049	30.67	1.095	0.002	0.898	0.014	0.0005	0.0020	63.45	0.0005	0.0086
7	3.019	0.00092	0.161	0.0053	0.046	30.62	1.05	0.0015	0.88	0.0061	0.0001	0.003	63.450	0.002	0.009
8	2.88	0.0003	0.1530	0.0039	0.04	30.316	1.05	0.0023	0.880	0.0104		0.0036	63.793	0.0013	0.007
9	3.02		0.156		0.048	30.84	1.10	0.0023	0.88	0.011			63.575	0.0004	0.0093
10	2.900		0.1520		0.048	30.70	0.991		0.891	0.0118				0.000513	0.009
11	2.9259		0.151		0.0386	30.620	0.997		0.8990					0.00067	0.0100
12	3.0135		0.1461		0.045	30.448	1.0486		0.894						0.00815
13	3.001				0.0484	30.554	1.0315		0.8794						0.0084
14							1.002								
Mean	2.9822	0.0009	0.1527	0.0049	0.0462	30.5522	1.0379	0.0021	0.8858	0.0111	0.0002	0.0030	63.6106	0.0010	0.0087
STDV.	0.0501	0.0007	0.0042	0.0007	0.0052	0.1450	0.0387	0.0003	0.0136	0.0025	0.0002	0.0006	0.1486	0.0007	0.0008
Certified	2.98	(0.001)	0.153	0.005	0.046	30.6	1.04	0.0021	0.89	0.011	(0.0002)	0.003	(63.6)	(0.001)	0.009
95% C.I.	0.03		0.003	0.001	0.003	0.1	0.02	0.0002	0.01	0.002		0.0005			0.0005
Methods	X,I,O	I,O	C,O	X,I,O	X,I,O	X,W,O	X,I,O	A,I,O	X,I,O	X,I,O	F	X,I,O	X,O	F	X,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

52C	S	Si	Ta	Ti	V	W	Ag	As	Bi	Ca	H	Pb	Sb	Sn	Zr
1	0.00222	0.14	0.0113	0.55	0.0031	0.0050	<0.0001	<0.0001	<0.0001	0.0012	0.0011	0.0002	<0.0001	0.00254	0.0510
2	0.0025	0.1343	0.00943	0.5599	0.0022	0.005	0.0002	0.0020	0.0001	0.0010	0.00023	0.0003	0.0006	0.0012	0.0517
3	0.0032	0.142	<0.0001	0.541	0.0037	0.005	<0.0001	0.00042	<0.0001	0.0016	0.0013	0.0004	<0.0001	0.0015	0.0501
4	0.0015	0.132	0.00033	0.567	0.001	0.007	<0.0002	0.00022	<0.0001			0.000388	0.00004	0.0011	0.053
5	0.0013	0.1415	0.0117	0.5429	0.0018		0.00024		0.00001			0.0004322		0.00023	0.048
6	0.0021	0.155	0.0085	0.56	0.003							0.0002		0.0001069	0.05
7	0.0024	0.148		0.55	0.0035									0.0006	0.0524
8	0.0019	0.117		0.552	0.0010										0.0485
9	0.0014	0.12		0.55	0.003										0.0525
10	0.0012	0.136		0.535	0.0031										
11	0.00116	0.1220		0.550											
12	0.0012	0.132		0.557											
13		0.1438		0.5549											
14															
Mean	0.0018	0.1357	0.0083	0.5515	0.0025	0.0055	0.0002	0.0009	0.0001	0.0013	0.0009	0.0003	0.0003	0.0010	0.0508
STDV.	0.0007	0.0112	0.0046	0.0086	0.0010	0.0010	0.0000	0.0010	0.0001	0.0003	0.0006	0.0001	0.0004	0.0008	0.0018
Certified	0.002	0.14		0.55	0.003	(0.01)				(0.001)		0.0003		(0.001)	0.051
95% C.I.	0.0004	0.01		0.01	0.001							0.0001			0.001
Methods	C,I,O	X,W,I,O	X,I,O	X,I,O	X,I,O	X,I				I		H,I,O		H,A,I,O	X,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

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 instrument procedures.

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. Each member of the ILAP is furnished a sample pack from a specific location on the batch bar. 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

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