



Certificate of Analysis

IARM 8F

AISI 347 / UNS S34700

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.004 ± 0.001	C	0.048 ± 0.001	Co	0.155 ± 0.002	Cr	17.36 ± 0.06
Cu	0.454 ± 0.007	Mn	1.54 ± 0.01	Mo	0.424 ± 0.009	N	0.042 ± 0.001
Nb	0.64 ± 0.02	Ni	9.01 ± 0.05	O	0.004 ± 0.001	P	0.033 ± 0.001
S	0.010 ± 0.002	Si	0.468 ± 0.008	Sn	0.011 ± 0.002	Ta	0.005 ± 0.003
Ti	0.0030 ± 0.0007	V	0.084 ± 0.004	W	0.029 ± 0.004		

Indicative Values listed in ppm

Ag (<2)	As (70)	B (10)	Bi (<10)	Ca (4)	Mg (<2)	Pb (20)
Se (<25)	Zn (<60)	Zr (<120)				

Description and Intended Use

This CRM may come in the form of a solid disc or chips. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods.

Interpretation of Data

1. Certified values listed 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. This material was tested using both the solid disks and chips prepared from individual sections of bar. The certified values are considered representative of the overall average composition of the material.
3. 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.
4. "Provisional Certificate of Analysis" reports values that support a fully certified reference material; it also indicates that values may be in a continued process of statistical evaluation and are subject to change.
5. Chips are not certified for Oxygen analysis.



The following data and accompanying statements represent all pertinent information reported in the ILAP as it applies to the chemical characterization of this material.

	Ag	Al	As	B	Bi	C	Ca	Co	Cr	Cu	Mg	Mn	Mo	N	Nb	Ni
1	0.0001	0.0006	0.0042	0.0001	0.00001	0.0456	0.0002	0.1492	17.2696	0.4329	0.0001	1.509	0.404	0.0392	0.586	8.868
2	0.00015	0.0018	0.0076	0.00011	<0.00001	0.046	0.0003	0.15	17.271	0.4465	0.0002	1.522	0.408	0.0392	0.594	8.914
3		0.0024	0.008	0.0002	<0.0010	0.0465	0.00037	0.151	17.28	0.4465	<0.0001	1.522	0.414	0.0404	0.6253	8.935
4		0.003	0.0082	0.0004		0.0466	0.0006	0.1518	17.29	0.448		1.524	0.414	0.04129	0.626	8.98
5		0.0033	0.0089	0.0006		0.0467	<0.001	0.153	17.306	0.451		1.533	0.4151	0.0415	0.628	8.981
6		0.0033		0.0007		0.0467		0.154	17.31	0.451		1.5355	0.416	0.042	0.638	8.99
7		0.004		0.0011		0.0479		0.155	17.318	0.452		1.536	0.417	0.0427	0.642	9.004
8		0.0052		0.0026		0.0486		0.155	17.35	0.453		1.54	0.4226	0.0429	0.647	9.009
9		0.0052		0.0044		0.049		0.1553	17.354	0.454		1.542	0.424	0.043	0.6495	9.0497
10		0.007				0.0499		0.1566	17.3935	0.456		1.5431	0.43	0.043	0.6535	9.062
11						0.05		0.157	17.417	0.46		1.5443	0.4419	0.044	0.6563	9.09
12						0.0516		0.162	17.55	0.47		1.55	0.442	0.045	0.6596	9.11
13								0.162	17.573	0.481		1.58	0.459		0.69	9.1566
14																
15																
Mean	0.0001	0.004	0.007	0.001		0.048	0.0004	0.155	17.36	0.454	0.0002	1.54	0.424	0.042	0.64	9.01
STDV.	0.00004	0.002	0.002	0.001		0.002	0.0002	0.004	0.1	0.01	0.00007	0.02	0.02	0.002	0.03	0.08
Certified	<0.0002	0.004	(0.007)	(0.001)	<0.001	0.048	(0.0004)	0.155	17.36	0.454	<0.0002	1.54	0.424	0.042	0.64	9.01
95% C.I.	0.001	0.001				0.001		0.002	0.06	0.007		0.01	0.009	0.001	0.02	0.05
Methods	H,G	X,O,I	X,O,I,H,G	O,I	O,H,G	O,C	O,I,G	X,W,O,I	X,W,O,I	X,O,I	I,H,G	X,O,I	X,O,I	O,F	X,O,I	X,W,O,I

	O	P	Pb	S	Se	Si	Sn	Ta	Ti	V	W	Zn	Zr			
1	0.0022	0.0283	0.0001	0.0018	0.0001	0.4504	0.007	0.0005	0.001	0.0717	0.02	0.0001	0.0024			
2	0.0028	0.031	0.00026	0.0058	0.0002	0.456	0.009	0.001	0.00177	0.0742	0.0227	0.00019	0.0062			
3	0.00303	0.0312	0.0005	0.0091	<0.00005	0.457	0.009	0.004	0.0023	0.0754	0.025	0.0056	0.0119			
4	0.0033	0.0318	0.0052	0.0095	<0.0010	0.46	0.0097	0.005	0.0024	0.0807	0.026		<0.0001			
5	0.0033	0.032	<0.0001	0.0096	<0.0025	0.466	0.01	0.005	0.003	0.082	0.026		<0.001			
6	0.0036	0.0321	<0.0020	0.0099		0.468	0.0106	0.0078	0.003	0.0855	0.0281		<0.001			
7	0.0043	0.033		0.01078		0.469	0.011	0.01	0.0031	0.0863	0.0309		<0.0010			
8	0.0044	0.034		0.011		0.472	0.012		0.0032	0.088	0.031					
9	0.0044	0.0341		0.011		0.474	0.013		0.0034	0.088	0.0331					
10	0.0073	0.0342		0.011		0.4802	0.014		0.0036	0.089	0.036					
11		0.0347		0.0122		0.49	0.0151		0.004	0.09	0.0372					
12		0.037		0.0127					0.005	0.09						
13				0.0171						0.094						
14																
15																
Mean	0.004	0.033	0.002	0.01	0	0.468	0.011	0.005	0.003	0.084	0.029	0.002	0.01			
STDV.	0.001	0.002	0.002	0.004	0.006	0.01	0.002	0.003	0.001	0.007	0.005	0.003	0.005			
Certified	0.004	0.033	(0.002)	0.010	<0.0025	0.468	0.011	0.005	0.0030	0.084	0.029	<0.006	<0.012			
95% C.I.	0.001	0.001	0.002	0.002	0.008	0.008	0.002	0.003	0.0007	0.004	0.004					
Methods	F	X,O,I	O,I,H,G	O,C	O,IM,I,H,G	X,W,O,I	X,O,I	X,O,I	X,O,I,G	X,O,I	X,O,I	I,H,G	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

Participating Laboratories

Colorado Metallurgical Services
Crucible Industries
Laboratory Testing, Inc.
Exova - Portland
TimkenSteel Corporation
ATI Flat Rolled Products, Latrobe

Denver, CO
Syracuse, NY
Hatfield, PA
Portland, OR
Canton, OH
Latrobe, PA

Latrobe Specialty Metals, A Carpenter Co.
Exova - Glendale Heights
Special Metals IncoTest
Alcoa Howmet, Dover Alloy
Anderson Laboratories, Inc.
PM Kalco, Inc

Latrobe, PA
Glendale Heights, IL
Hereford, UK
Dover, NJ
Greendale, WI
Wheatland, PA

Traceability

Members of the "Inter-Laboratory Analysis Program" (ILAP) validate test methods and instrument performance utilizing SRMs, CRMs, and RMs produced by recognized Certifying Bodies. The specific SRMs, CRMs, and RMs applicable to the material covered by this certificate are:

ALPHA AR511	ALPHA AR654	ALPHA AR669	ALPHA AR891	BAS 408/1	BAS 409/1	BAS 410/2	BAS 401/1	BAS 401/2
BAS 402/1	BAS 403/1	BAS 404/1	BAS 405/1	BAS 406/1	BAS 407/2	BAS 421	BAS 422	BAS 465/1
BAS 466/1	BCS 346A	BCS 351	BCS 407	BCS 454/1	BCS 455	BCS 457/2	BCS 462/1	BS 347A
BS 347A	BS 347A	BS 87E	BS 87F	BS CA-1	C1151	C1152	C1153	C1154
CA1A	CA-2	CA-3	CA316-4	CA3A	CA-4	ES 281-1	IARM 15B	IARM 21B
IARM 2C	IARM 4B	IARM 8B	IARM 8D	IARM 8D	IH R5657	JSS 003-1	JSS 168-4	JSS 170-4
JSS 171-4	JSS 173-4	JSS 175-4	JSS169-4	JSS172-4	JSS174-4	LECO 501-271	LECO 501-503	LECO 501-503
LECO 501-510	LECO 501-551	LECO 501-643	LECO 501-644	LECO 501-645	LECO 502-102	LECO 502-257	NIST 121A	NIST 101C
NIST 101G	NIST 1152	NIST 1154	NIST 1160	NIST 1161	NIST 1162	NIST 1163	NIST 1164	NIST 1172
NIST 1172	NIST 121D	NIST 123B	NIST 1260	NIST 1261	NIST 1262	NIST 1262	NIST 1263	NIST 1264
NIST 131G	NIST 16F	NIST 175A	NIST 1760	NIST 1761	NIST 1762	NIST 1763	NIST 1763	NIST 1764
NIST 1765	NIST 1765	NIST 1766	NIST 1767	NIST 2171	NIST 2172	NIST 3103A	NIST 3107	NIST 3109A
NIST 3128	NIST 3131A	NIST 3151	NIST 3161	NIST 3163	NIST 3165	NIST 3168A	NIST 3169	NIST 339
NIST 343A	NIST 346	NIST 368	NIST 72F	NIST 73C	XAAS	XCCS	XCCV	

Homogeneity and Uncertainty

"Uncertainty" values, as reported adjacent to certified concentration values, are based on a 95% Confidence Interval. These estimated uncertainties include the combined effects of method imprecision, material inhomogeneity, and any bias between methods. Homogeneity data from experimental XRF results are reflected in both the overall statistics and certified data. Homogeneity samples are selected by a systematic sampling procedure. The number of samples may be determined by equation 1, where N_{prod} is the number of units produced and N_{min} is the number of samples used for homogeneity testing. These samples are arranged in a simple randomized design such that each sample is analyzed multiple times by XRF. Homogeneity is also determined within sample using an applied version of ASTM E826. A single factor ANOVA is used to calculate uncertainty due to inhomogeneity (U_{hom}). Uncertainty of the material is calculated by equation 2, where $H=U_{hom}$, S = Standard deviation, t = t-value at 95% CI, and n = number of observations.

$$1. N_{min} = \max(10, \sqrt[3]{N_{prod}})$$

$$2. U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

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 with the information detailed in ISO Guide 31. The only generally accepted certifying body in the United States for primary standards or 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, with one or more property values that 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, with one or more property values 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): ASTM Standard E691-87 applies to inter-laboratory studies to "Determine the Precision of a Single Test Method", but also outlines a well thought out and logical plan for conducting an inter laboratory program involving multiple analytical techniques. Therefore, the guidelines established in ASTM E691-87 were applied to all aspects of this inter laboratory program, including the protocols for planning, handling, analysis and treatment of resulting data.

Methods of Analysis: The "Inter Laboratory Analysis Program" analyzes a wide variety of materials, and as a result, no single analytical method would provide optimum analytical results. Therefore, a combination of ASTM Standard Methods for classical wet chemistry, ICP, AA, Optical Emission, X-Ray spectrometric, and other accepted methods were used to produce analytical data. Carbon, Sulfur, Nitrogen, and Oxygen results were supplied from 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 on 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. The minimum sample size for chips should be individually evaluated based on the analytical technique used; this would typically be greater than 0.1 grams. The material should be stored in a cool, dry location when not in use. **Chips are not to be used for Oxygen analysis.**

Selection of Materials: A "batch" or "series" is defined as a continuous length of bar produced from a single heat. The majority of IARM materials are in wrought condition; other methods of manufacture are utilized if necessary. ILAP samples are removed from equal sections from the total length of the bar. A portion of each section is converted to chips and a 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.



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