



# Certificate of Analysis

## IARM 302B

Alloy 254SMO / UNS S31254

### Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

<b>Al</b>	<b>0.0159 ± 0.0006</b>	<b>B</b>	<b>0.0027 ± 0.0003</b>	<b>C</b>	<b>0.0226 ± 0.0008</b>	<b>Co</b>	<b>0.072 ± 0.003</b>
<b>Cr</b>	<b>20.33 ± 0.05</b>	<b>Cu</b>	<b>0.701 ± 0.008</b>	<b>Mg</b>	<b>0.0009 ± 0.0006</b>	<b>Mn</b>	<b>0.93 ± 0.02</b>
<b>Mo</b>	<b>6.24 ± 0.07</b>	<b>N</b>	<b>0.180 ± 0.003</b>	<b>Nb</b>	<b>0.012 ± 0.003</b>	<b>Ni</b>	<b>17.7 ± 0.1</b>
<b>O</b>	<b>0.0032 ± 0.0009</b>	<b>P</b>	<b>0.0256 ± 0.0007</b>	<b>S</b>	<b>0.0007 ± 0.0002</b>	<b>Si</b>	<b>0.56 ± 0.01</b>
<b>Sn</b>	<b>0.0075 ± 0.0008</b>	<b>Ta</b>	<b>0.004 ± 0.001</b>	<b>Ti</b>	<b>0.0031 ± 0.0008</b>	<b>V</b>	<b>0.052 ± 0.002</b>
<b>W</b>	<b>0.025 ± 0.006</b>						

Indicative Values listed in ppm

As (90)	Ca (31)	H (<10)	Pb (10)	Sb (18)	Se (6)	Zn (<100)
Zr (<100)						

#### 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.

	Al	As	B	C	Ca	Co	Cr	Cu	H	Mg	Mn	Mo	N	Nb	Ni	O
1	0.0148	0.0073	0.0021	0.02	0.0028	0.066	20.20	0.67	0.00024	0.0003	0.87	6.07	0.17	0.001	17.51	0.0008
2	0.015	0.0075	0.0023	0.0215	0.003	0.0666	20.2324	0.6845		0.0005	0.904	6.097	0.173	0.007	17.5572	0.0015
3	0.015	0.0076	0.0025	0.0219	0.0032	0.067	20.239	0.69		0.0009	0.905	6.144	0.1766	0.0077	17.634	0.0026
4	0.01567	0.012	0.0025	0.0221	0.0033	0.068	20.251	0.691		0.0009	0.9127	6.146	0.1769	0.011	17.644	0.00317
5	0.016	<0.001	0.0027	0.0223	<0.005	0.0686	20.27	0.698		0.0011	0.92	6.184	0.177	0.0112	17.644	0.0032
6	0.0161	<0.002	0.0027	0.0224		0.069	20.31	0.7017		0.0019	0.9256	6.1881	0.1776	0.0119	17.65	0.00324
7	0.0165		0.0028	0.0226		0.0697	20.3439	0.703			0.931	6.22	0.1787	0.0123	17.66	0.0033
8	0.0166		0.0029	0.023		0.0713	20.366	0.7092			0.933	6.221	0.18	0.0124	17.6621	0.0033
9	0.017		0.0029	0.0232		0.0749	20.3722	0.71			0.9439	6.232	0.182	0.014	17.6703	0.0035
10			0.003	0.0237		0.076	20.40	0.71			0.9493	6.249	0.1844	0.014	17.694	0.004
11			0.0035	0.0237		0.076	20.402	0.712			0.95	6.2723	0.1855	0.017	17.711	0.0061
12				0.0247		0.077	20.418	0.713			0.955	6.287	0.186	0.017	17.74	
13						0.0799	20.433	0.716			0.964	6.4528	0.1876	0.019	18.0586	
14												6.541			18.117	
15																
Mean	0.0159	0.009	0.0027	0.0226	0.0031	0.072	20.33	0.701		0.0009	0.93	6.24	0.18	0.012	17.7	0.0032
STDV.	0.0008	0.002	0.0004	0.001	0.0002	0.005	0.08	0.01		0.0006	0.03	0.1	0.005	0.005	0.2	0.001
<b>Certified</b>	<b>0.0159</b>	<b>(0.009)</b>	<b>0.0027</b>	<b>0.0226</b>	<b>(0.0031)</b>	<b>0.072</b>	<b>20.33</b>	<b>0.701</b>	<b>(&lt;0.001)</b>	<b>0.0009</b>	<b>0.93</b>	<b>6.24</b>	<b>0.180</b>	<b>0.012</b>	<b>17.7</b>	<b>0.0032</b>
95% C.I.	0.0006		0.0003	0.0008		0.003	0.05	0.008		0.0006	0.02	0.07	0.003	0.003	0.1	0.0009
Methods	X,O,I,G	O,IM,H	O,I,G	O,C		X,O,I,G	X,W,O,I,G	X,O,I,G	F	O,I,H,A	X,O,I,G	X,O,I,G	O,F	X,O,I,G	X,W,O,I,G	F

	P	Pb	S	Sb	Se	Si	Sn	Ta	Ti	V	W	Zn	Zr			
1	0.023	0.0001	0.0001	0.0017	0.0001	0.52	0.0057	0.0028	0.0013	0.0473	0.0037	0.0005	0.0004			
2	0.024	0.0002	0.0004	0.0018	0.0002	0.525	0.0067	0.0028	0.0018	0.0503	0.0147	0.0008	0.0005			
3	0.0244	0.0002	0.0005		0.0002	0.543	0.007	0.004	0.002	0.051	0.017	0.0008	0.0008			
4	0.0245	0.0006	0.0005		0.001	0.558	0.0074	0.0041	0.002	0.0512	0.021	0.01	0.0008			
5	0.0253	0.0009	0.0006		0.0017	0.5584	0.0075	0.0048	0.0021	0.052	0.022	0.0112	0.0019			
6	0.0254	0.005	0.0006		<0.0001	0.559	0.0075	0.005	0.003	0.0528	0.024	<0.005	0.007			
7	0.0256		0.0006		<0.005	0.5593	0.0077	0.0064	0.0037	0.053	0.027		0.0096			
8	0.026		0.0007			0.56	0.008		0.0038	0.053	0.028		<0.001			
9	0.026		0.0007			0.5625	0.0098		0.0038	0.055	0.0286		<0.010			
10	0.0262		0.00088			0.567			0.0041	0.0552	0.0298					
11	0.0263		0.001			0.5704			0.0047		0.03					
12	0.0267		0.001			0.577			0.005		0.033					
13	0.027		0.001			0.584					0.041					
14	0.0279					0.593										
15																
Mean	0.0256	0.001	0.0007	0.0018	0.0006	0.56	0.0075	0.004	0.0031	0.052	0.025	0.005	0.003			
STDV.	0.001	0.002	0.0003	0.00007	0.0007	0.02	0.001	0.001	0.001	0.002	0.009	0.005	0.004			
<b>Certified</b>	<b>0.0256</b>	<b>(0.001)</b>	<b>0.0007</b>	<b>(0.0018)</b>	<b>(0.0006)</b>	<b>0.56</b>	<b>0.0075</b>	<b>0.004</b>	<b>0.0031</b>	<b>0.052</b>	<b>0.025</b>	<b>(&lt;0.01)</b>	<b>(&lt;0.01)</b>			
95% C.I.	0.0007		0.0002			0.01	0.0008	0.001	0.0008	0.002	0.006					
Methods	X,W,O,I,G	O,IM,H	O,C	IM	O,IM,I,H	X,W,O,I,G	X,O,IM,I	X,O,I	X,O,I,G	X,O,I,G	X,O,I,G	O,IM,I,H	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



## Participating Laboratories

LECO Corporation  
Colorado Metallurgical Services  
Special Metals IncoTest  
Huntington Alloys Corporation  
Anderson Laboratories, Inc.  
Exova - Portland

St. Joseph, MI  
Denver, CO  
Hereford, UK  
Huntington, WV  
Greendale, WI  
Portland, OR

Exova - Alburdis  
Laboratory Testing, Inc.  
Haynes International, Inc.  
PM Kalco, Inc  
IMR Test Labs  
Latrobe Specialty Metals, A Carpenter Co.

Los Angeles, CA  
Hatfield, PA  
Kokomo, IN  
Wheatland, PA  
Lansing, NY  
Latrobe, 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 AR1647	ALPHA AR1652	ALPHA AR654	ALPHA AR663	ALPHA AR669	ALPHA AR869	ALPHA AR881	ALPHA AR890	ALPHA AR892
BCS 351	BCS 462/1	BS 17-4PHA	BS 17-4PHB	BS 189	BS 192	BS 83G	BS 85D	BS 91E
CK3MCUN	HAS 317B	IARM 100B	IARM 152B	IARM 157A	IARM 157B	IARM 17C	IARM 23B	IARM 302A
IARM 4C	IARM 56D	IARM 60B	IARM 68B	IARM 7A	IARM 7B	IARM 99A	IH R5657	JK 27A
LECO 502-072	LECO 501-501	LECO 501-502	LECO 501-503	LECO 501-551	LECO 501-644	LECO 501-674	LECO 501-675	LECO 501-992
LECO 502-016	LECO 502-072	LECO 502-102	LECO 502-257	LECO 502-416	LN75400	MBH 13X12535BC	MBH 13X12853	MBH 13X31008A
MBH 13X31603A	MBH 13XNSA11A	MBH 13XNSA4A	NIST 121D	NIST 132B	NIST 134A	NIST 160A	NIST 1763	NIST 1765
NIST 2424A	NIST 3101A	NIST 3103A	NIST 3106	NIST 3107	NIST 3109A	NIST 3128	NIST 3131A	NIST 3137
NIST 3149	NIST 3155	NIST 3161A	NIST 3162A	NIST 3163	NIST 3165	NIST 3168A	NIST 3169	NIST 348
NIST 348A	NIST 349A	NIST 361	NIST 362	NIST 363	NIST 367	NIST 864	NIST 867	NIST C2400
R1444	REF 254	RR654	SUS NZ6000	SUS RE12/2	SUS RH12/3	SUS RH18/10	SUS RH31/8	SUS RN13/0
SUS RN14/18	SUS RN2/19	SUS RN5/28	SYN Q6FB					

### 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.



David Coler, General Manager

Analytical Reference Materials International



Analytical Reference Materials International • 276 Abby Road • Manchester, NH 03103  
Telephone (603) 935-4100 • Fax (603) 935-4101 • www.ARMi.com • ARMI@LGCgroup.com

302B-10102017-IARM-F

10/10/2017 3 / 3