

Certificate of Analysis

IARM Ni282-18

Nickel Alloy 282 / UNS N07208

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	1.57 ± 0.04	B	0.0014 ± 0.0005	C	0.060 ± 0.003	Co	10.38 ± 0.08
Cr	19.4 ± 0.1	Cu	0.012 ± 0.001	Fe	0.90 ± 0.04	Mg	0.0054 ± 0.0006
Mn	0.042 ± 0.004	Mo	8.40 ± 0.09	Nb	0.058 ± 0.007	Ni	56.8 ± 0.3
P	0.003 ± 0.001	S	0.0006 ± 0.0004	Si	0.054 ± 0.008	Ti	2.20 ± 0.07
V	0.013 ± 0.006	W	0.043 ± 0.009	Zr	0.0014 ± 0.0009		

Indicative Values listed in ppm

Ag (<1)	As (<50)	Au (<1)	Ba (<1)	Be (<1)	Bi (<2)	Br (<1)
Ca (<20)	Cd (<1)	Ce (<1)	Cl (<1)	Cs (<1)	Dy (<1)	Er (<1)
Eu (<1)	F (<1)	Ga (19)	Gd (<1)	Ge (<1)	Hf (<1)	Hg (<1)
Ho (<1)	I (<1)	In (<1)	Ir (<1)	K (<5)	La (<1)	Li (<1)
Lu (<1)	N (73)	Na (<5)	Nd (<2)	O (<20)	Os (<1)	Pb (<1)
Pd (<1)	Pr (<1)	Pt (<1)	Rb (<5)	Re (<1)	Rh (<1)	Ru (<1)
Sb (<2)	Sc (<1)	Se (<10)	Sm (<1)	Sn (3)	Sr (<2)	Ta (<100)
Tb (<1)	Te (<1)	Th (<1)	Tl (<1)	Tm (<1)	U (<1)	Y (<20)
Yb (<1)	Zn (<70)					

Description and Intended Use

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

Instructions for Use

1. The test surface is on the opposite side of the labeled surface, which includes the material identification. 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.
2. 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.
3. The material should be stored in a cool, dry location when not in use.
4. Chips are not certified for Oxygen analysis.

The following data represents all pertinent information reported as it applies to the chemical characterization of this material.

	Al	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	Nb	Ni	P	S	Si	Ti
1	1.46	0.0003	0.054	10.19	19.093	0.01	0.8043	0.0045	0.0334	8.1643	0.048	56.18	0.00107	0.0002	0.032	2.06
2	1.538	0.0008	0.0568	10.192	19.2856	0.0105	0.81	0.005	0.036667	8.3063	0.05	56.428	0.0012	0.0003	0.04	2.13
3	1.55	0.0009	0.0577	10.3333	19.3462	0.011	0.88	0.0052	0.0369	8.3751	0.0501	56.655	0.0013	0.0004	0.047	2.156
4	1.56	0.0011	0.058	10.35	19.35	0.012	0.906	0.0052	0.0374	8.38	0.054	56.775	0.002	0.0004	0.051	2.167
5	1.569	0.0012	0.058	10.3689	19.43	0.012	0.91	0.0054	0.04	8.393	0.055	56.867	0.002	0.00049	0.053	2.181
6	1.60	0.0015	0.0605	10.39	19.46	0.0125	0.9167	0.0055	0.041	8.418	0.055	56.9467	0.0026	0.00058	0.054	2.196
7	1.6107	0.0015	0.062	10.455	19.519	0.0132	0.917	0.0067	0.041	8.441	0.06	56.9612	0.0027	0.001	0.054	2.223
8	1.621	0.0017	0.0628	10.457	19.547	0.014	0.92		0.044	8.54	0.0632	57.2063	0.00467	0.00163	0.0559	2.302
9	1.6544	0.0018	0.0673	10.474	19.6127	0.015	0.932		0.045	8.548	0.066		0.0055		0.0574	2.3476
10		0.0021		10.55			0.934		0.051		0.081				0.0615	
11		0.003					1.02		0.0535						0.0616	
12															0.08	
13																
14																
15																
Mean	1.57	0.0014	0.060	10.38	19.4	0.012	0.9	0.0054	0.042	8.40	0.058	56.8	0.003	0.0006	0.054	2.20
STDV.	0.06	0.0007	0.004	0.10	0.2	0.002	0.06	0.0007	0.006	0.10	0.010	0.3	0.002	0.0005	0.010	0.09
Certified	1.57	0.0014	0.060	10.38	19.4	0.012	0.90	0.0054	0.042	8.40	0.058	56.8	0.003	0.0006	0.054	2.20
U _{CRM}	0.04	0.0005	0.003	0.08	0.1	0.001	0.04	0.0006	0.004	0.09	0.007	0.3	0.001	0.0004	0.008	0.07
Methods	X,I,G	O,IM,I,G	C	X,I,G	X,W,I,G	X,IM,I,G	X,I,G	O,IM,I,G	X,IM,I,G	X,I,G	X,IM,I,G	X,I	X,IM,I,G	X,G,C	X,O,IM,I,G	X,G,I

	V	W	Zr	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Cl	Cs	Dy
1	0.0058	0.017	0.00046	0.000018	0.00021	<0.00001	<0.00005	<0.00005	0.000028	<0.00005	0.000016	0.00005	0.000012	0.0000061	<0.00001	<0.00001
2	0.0081	0.0387	0.00065	<0.00005	0.00031	<0.00001	<0.00003	<0.00001	0.0002	<0.00005	0.000026	<0.00002	<0.00005	<0.000001	<0.00001	<0.00005
3	0.0087	0.0407	0.0007	<0.00005	<0.005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.005	<0.00005	<0.00005	<0.000001	<0.00005	<0.00005
4	0.0093	0.041	0.0009													
5	0.012	0.041	0.002													
6	0.014	0.042	0.0024													
7	0.018	0.043	0.003													
8	0.0271	0.05														
9		0.05														
10		0.07														
11																
12																
13																
14																
15																
Mean	0.013	0.043	0.0014													
STDV.	0.007	0.01	0.0010													
Certified	0.013	0.043	0.0014	<0.0001	<0.005	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	(0.002)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
U _{CRM}	0.006	0.009	0.0009													
Methods	X,IM,I,G	X,IM,I,G	X,IM,I,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G

	Er	Eu	F	Ga	Gd	Ge	Hf	Hg	Ho	I	In	Ir	K	La	Li	Lu
1	<0.00001	<0.00001	<0.00001	0.0018	<0.00001	0.000017	0.000017	<0.00001	<0.00001	<0.00001	<0.00001	<0.00005	0.000008	0.000001	<0.000005	<0.00001
2	<0.00005	<0.00005	<0.00001	0.0019	<0.00005	0.00005	0.00004	<0.00005	<0.00005	<0.00001	<0.00001	<0.00001	<0.00005	<0.00001	<0.00001	<0.00005
3	<0.00005	<0.00005		0.0021	<0.00005	<0.0001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
4																
5																
6																
7																
8																
9																
10																
Mean																
STDV.																
Certified	<0.0001	<0.0001	<0.0001	(0.0019)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001
95% C.I.																
Methods	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G

	N	Na	Nd	O	Os	Pb	Pd	Pr	Pt	Rb	Re	Rh	Ru	Sb	Sc	Se
1	0.0067	0.0000092	<0.00001	0.001	<0.00005	0.000066	0.000013	<0.00001	<0.00001	<0.00005	0.000043	<0.00001	<0.00001	0.00012	<0.00005	<0.00005
2	0.00734	<0.00001	<0.00005	0.001	<0.00001	0.000073	<0.00005	<0.00005	<0.00001	<0.0001	0.000052	<0.00001	<0.00005	0.00013	<0.00001	<0.0002
3	0.0074	<0.0005	<0.0002	0.00025	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0005	<0.00005	<0.00005	<0.0001	<0.0001	<0.00005	<0.001
4	0.0075			0.0014												
5	0.0076															
6																
7																
8																
9																
10																
Mean	0.0073															
STDV.	0.0004															
Certified	(0.0073)	<0.0005	<0.0002	<0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.001
95% C.I.																
Methods	F	IM,G	IM,G	F	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G

	Sm	Sn	Sr	Ta	Tb	Te	Th	Tl	Tm	U	Y	Yb	Zn
1	<0.00001	0.00027	<0.00005	0.00013	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	0.000024	<0.00005	<0.00001	0.000046
2	<0.00005	0.00033	<0.0005	0.00013	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	0.000003	<0.0005	<0.00005	0.000053
3	<0.00005	0.00035	<0.002	0.006	<0.00005	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.002	<0.00005	<0.007
4				0.0095									
5				<0.00005									
6													
7													
8													
9													
10													
Mean													
STDV.													
Certified	<0.0001	(0.0003)	<0.002	<0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.0001	<0.007
95% C.I.													
Methods	IM,G	IM,G	IM,G	X,IM,I,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,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



Certification Laboratories

Haynes International, Inc.
Laboratory Testing, Inc.
ATI Specialty Materials, Lockport
LECO Corporation
EAG Laboratories

Kokomo, IN
Hatfield, PA
Lockport, NY
St. Joseph, MI
Liverpool, NY

NSL Analytical Services
ATI Specialty Materials, Monroe
revierlabor GmbH
Northern Analytical Laboratory
VHG Labs

Cleveland, OH
Monroe, NC
Essen, Germany
Londonderry, NH
Manchester, NH

Certification laboratories have demonstrated performance and traceability by utilizing test methods under the scope of ISO 17025 or have shown competence through a proficiency testing program. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

NIST 865 NIST 868 NIST 867 NIST 161 NIST 349 NIST 3131A NIST 1244 NIST 3107 NIST 3169 MBH 24X07001H

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 may also be 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.

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

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

Expiration

The certification of this material is valid indefinitely, within the uncertainty specified, provided the material is handled and stored in accordance with the instructions stated on this certificate. The certification is nullified if the material is damaged, contaminated, otherwise modified, or used in a manner for which it was not intended.



David Coler, General Manager

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3 / 3