



ARMI

ISO Certified · 9001 · 17025 · 17043 · 17034

Certificate of Analysis

IARM NiC276-18

Nickel Alloy C-276 / UNS N10276

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.114 ± 0.005	B	0.0020 ± 0.0006	C	0.0032 ± 0.0007	Co	0.170 ± 0.007
Cr	15.9 ± 0.2	Cu	0.14 ± 0.01	Fe	6.09 ± 0.07	Mg	0.010 ± 0.002
Mn	0.42 ± 0.01	Mo	15.4 ± 0.2	N	0.017 ± 0.003	Nb	0.061 ± 0.005
Ni	58.5 ± 0.2	P	0.008 ± 0.003	S	0.0007 ± 0.0006	Si	0.017 ± 0.004
Ti	0.007 ± 0.001	V	0.018 ± 0.008	W	3.23 ± 0.04		

Indicative Values listed in ppm

Ag (<5)	As (<50)	Au (<1)	Ba (<1)	Be (<1)	Bi (<10)	Br (<1)
Ca (<50)	Cd (<50)	Ce (<1)	Cl (<1)	Cs (<1)	Dy (<1)	Er (<1)
Eu (<1)	F (<1)	Ga (<20)	Gd (<1)	Ge (<1)	H (<3)	Hf (<10)
Hg (<1)	Ho (<1)	I (<1)	In (<1)	Ir (<1)	K (<1)	La (<10)
Li (<1)	Lu (<1)	Na (<1)	Nd (<1)	O (10)	Os (<1)	Pb (<10)
Pd (<10)	Pr (<1)	Pt (<1)	Rb (<1)	Re (<10)	Rh (<1)	Ru (<1)
Sb (10)	Sc (<1)	Se (<50)	Sm (<1)	Sn (5)	Sr (<50)	Ta (<600)
Tb (<1)	Th (<1)	Tl (<1)	Tm (<1)	U (<1)	Y (<10)	Yb (<1)
Zn (<10)	Zr (<10)					

Description and Intended Use

This **Certified Reference Material** is covered under the scope of accreditation to **ISO 17034** by LGC Standards - Manchester, NH. As an ISO 17034 certified reference material, appropriate use of this material will fulfill the certified reference material and traceability requirements for use in **ISO 17025** certified laboratories. 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 recommended for gas 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	N	Nb	Ni	P	S	Si
1	0.1012	0.0014	0.0023	0.154	15.2293	0.098	5.917	0.0065	0.398	15.018	0.01179	0.053	58.124	0.001	0.0002	0.0107
2	0.105	0.0014	0.0023	0.1624	15.4378	0.1287	5.97	0.0081	0.4037	15.20	0.017	0.057	58.23	0.0034	0.00029	0.013
3	0.10667	0.0014	0.0031	0.1654	15.80	0.13	5.98	0.0093	0.408	15.26	0.0173	0.0574	58.30	0.007	0.0004	0.013
4	0.113	0.0014	0.00311	0.17	15.89	0.13667	6.07	0.0099	0.41	15.29	0.0174	0.058	58.4213	0.0074	0.00045	0.0138
5	0.1141	0.0014	0.0038	0.17	15.89	0.14	6.08	0.0102	0.413	15.35	0.0174	0.06	58.4925	0.0078	0.0007	0.0155
6	0.117	0.0017	0.004	0.176	15.90	0.142	6.1472	0.0104	0.4153	15.4074	0.0198	0.0618	58.5383	0.0085	0.0011	0.0184
7	0.1183	0.002	0.004	0.1762	16.03	0.1448	6.153	0.012	0.4184	15.42		0.067	58.6933	0.0094	0.002	0.0184
8	0.12	0.0024		0.18	16.1068	0.148	6.16667	0.0133	0.42	15.4591		0.07	58.84	0.01		0.0201
9	0.12	0.003		0.18	16.12	0.166	6.2022		0.438	15.48				0.01		0.027
10	0.123	0.0036			16.2343		6.2072		0.45	15.822				0.0132		
11														0.01367		
12																
13																
14																
15																
Mean	0.114	0.002	0.0032	0.17	15.9	0.14	6.09	0.01	0.42	15.4	0.017	0.061	58.5	0.008	0.0007	0.017
STDV.	0.007	0.0008	0.0007	0.009	0.3	0.02	0.1	0.002	0.02	0.2	0.003	0.006	0.2	0.004	0.0006	0.005
Certified	0.114	0.0020	0.0032	0.170	15.9	0.14	6.09	0.010	0.42	15.4	0.017	0.061	58.5	0.008	0.0007	0.017
U _{CRM}	0.005	0.0006	0.0007	0.007	0.2	0.01	0.07	0.002	0.01	0.2	0.003	0.005	0.2	0.003	0.0006	0.004
Methods	X,O,I,IM,G	O,I,IM,G	C,O	X,O,IM,I	X,W,O,IM,I	X,O,IM,I,G	X,O,I	X,I,O,IM,G	X,O,I	X,O,I	F	X,O,IM,G	X,O,I	O,IM,X,I,G	C,O,X,G	O,I,X,IM,G

	Ti	V	W	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Cl	Cs	Dy
1	0.0053	0.008	3.09667	<0.0005	0.0016	<0.00001	<0.000005	<0.0000005	<0.000005	<0.000005	0.000022	<0.0005	<0.000005	<0.000001	<0.000001	<0.000001
2	0.0059	0.011	3.204	<0.0005	<0.005				<0.00005		<0.005	<0.005				
3	0.0065	0.012	3.215		<0.005				<0.001		<0.005					
4	0.007	0.0121	3.22													
5	0.007	0.0123	3.2282													
6	0.0081	0.013	3.2352													
7	0.01	0.01333	3.236													
8	0.01	0.015	3.2395													
9		0.0176	3.28													
10		0.04	3.3473													
11		0.0401														
12																
Mean	0.007	0.018	3.23													
STDV.	0.002	0.01	0.06													
Certified	0.007	0.018	3.23	<0.0005	<0.005	<0.00001	<0.00001	<0.00001	<0.001	<0.00001	<0.005	<0.005	<0.00001	<0.00001	<0.00001	<0.00001
U _{CRM}	0.001	0.008	0.04													
Methods	X,O,IM,G	X,O,IM,I,G	X,O,I	IM,G	IM,G	G	G	G	IM,G	G	IM,G	IM,G	G	G	G	G

	Er	Eu	F	Ga	Gd	Ge	H	Hf	Hg	Ho	I	In	Ir	K	La	Li
1	<0.000001	<0.000001	<0.00001	0.0017	<0.000001	0.000056	0.0003	0.000001	<0.00001	<0.000001	<0.000001	<0.00001	0.000005	<0.000005	0.000003	<0.000005
2								<0.0005							<0.001	
3								<0.001								
4																
5																
6																
7																
8																
9																
10																
Mean																
STDV.																
Certified	<0.00001	<0.00001	<0.00001	<0.002	<0.00001	<0.00001	<0.0003	<0.001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.001	<0.00001
U _{CRM}																
Methods	G	G	G	G	G	G	F	IM,X,G	G	G	G	G	G	G	IM,G	G

	Lu	Na	Nd	O	Os	Pb	Pd	Pr	Pt	Rb	Re	Rh	Ru	Sb	Sc	Se
1	<0.000001	<0.000001	<0.000001	0.0002	<0.000005	0.000017	<0.00001	<0.000001	<0.00001	<0.0001	0.00064	<0.00001	<0.00001	0.00089	<0.000005	0.00053
2				0.00104		<0.0001	<0.001				0.001			0.001		<0.0002
3				0.0011		<0.001								0.001		<0.005
4				0.0019										0.0011		
5																
6																
7																
8																
9																
10																
Mean				0.0010										0.00100		
STDV.				0.0007										0.00009		
Certified	<0.00001	<0.00001	<0.00001	0.001	<0.00001	<0.001	<0.001	<0.00001	<0.00001	<0.00001	<0.001	<0.00001	<0.00001	0.001	<0.00001	<0.005
U _{CRM}																
Methods	G	G	G	F	G	IM,G	IM,G	G	G	G	IM,X,G	G	G	IM,G	G	IM,G

	Sm	Sn	Sr	Ta	Tb	Te	Th	Tl	Tm	U	Y	Yb	Zn	Zr
1	<0.000001	0.00038	<0.0005	0.000022	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.0005	<0.000001	0.000067	0.00012
2		0.0004		0.0032							<0.001		0.00067	<0.0005
3		0.0006		0.06							<0.001		<0.001	<0.001
4		<0.001		<0.0005										
5				<0.001										
6														
7														
8														
9														
10														
Mean		0.0005												
STDV.		0.0001												
Certified	<0.00001	0.0005	<0.005	<0.06	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.001	<0.00001	<0.001	<0.001
U _{CRM}														
Methods	G	IM,G	G	O,IM,G	G	G	G	G	G	G	IM,G	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.	Kokomo, IN	Laboratory Testing, Inc.	Hatfield, PA
Carpenter Technology - Athens Operations	Tanner, AL	Laboratorio Prove Materiali S. Marco srl	Schio, Italy
NSL Analytical Services	Cleveland, OH	Cannon-Muskegon	Muskegon, MI
EAG Laboratories, Inc.	Liverpool, NY	LGC Standards	Manchester, NH

Certification laboratories have demonstrated performance and traceability by utilizing a variety of test methods all under the scope of ISO 17025. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

IARM 65B

IARM 66B

NIST 343A

NBS C2402

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

Analytical Reference Materials International

