



ARMI

ISO Certified · 9001 · 17025 · 17043 · 17034

Certificate of Analysis

IARM NiPE16-18

Nickel Alloy PE16

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	1.20 ± 0.04	B	0.0028 ± 0.0003	C	0.052 ± 0.003	Co	0.77 ± 0.02
Cr	16.6 ± 0.2	Cu	0.053 ± 0.006	Fe	34.4 ± 0.6	Mn	0.122 ± 0.003
Mo	3.29 ± 0.02	N	0.006 ± 0.002	Nb	0.040 ± 0.003	Ni	42.9 ± 0.4
O	0.0006 ± 0.0005	P	0.006 ± 0.001	S	0.0007 ± 0.0003	Si	0.13 ± 0.01
Ti	1.18 ± 0.01	V	0.018 ± 0.004	W	0.038 ± 0.006	Zr	0.019 ± 0.003

Indicative Values listed in ppm

Ag (<5)	As (<50)	Au (<1)	Ba (<1)	Be (<1)	Bi (<10)	Br (<1)
Ca (<50)	Cd (<90)	Ce (<1)	Cl (<1)	Cs (<1)	Dy (<1)	Er (<1)
Eu (<1)	F (<1)	Ga (<20)	Gd (<1)	Ge (<3)	H (<3)	Hf (<500)
Hg (<1)	Ho (<1)	I (<1)	In (<1)	Ir (<1)	K (<1)	La (<1)
Li (<1)	Lu (<1)	Mg (<30)	Na (<1)	Nd (<1)	Os (<1)	Pb (<80)
Pd (<10)	Pr (<1)	Pt (<1)	Rb (<1)	Re (<1)	Rh (<1)	Ru (<1)
Sb (<10)	Sc (<1)	Se (<50)	Sm (<1)	Sn (<70)	Sr (<1)	Ta (<300)
Tb (<1)	Te (<1)	Th (<1)	Tl (<1)	Tm (<1)	U (<1)	Y (<10)
Yb (<1)	Zn (<40)					

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	Mn	Mo	N	Nb	Ni	O	P	S	Si
1	1.10	0.002	0.0402	0.708	16.28	0.031	33.741	0.111	3.237	0.003	0.03	41.916	0.0002	0.0037	0.0001	0.10
2	1.13	0.0023	0.05	0.745	16.37	0.041	33.91	0.118	3.241	0.0042	0.037	42.374	0.0003	0.0042	0.0003	0.1024
3	1.17	0.0027	0.0508	0.746	16.386	0.05	33.92	0.1187	3.276	0.00451	0.038	42.58	0.0003	0.0046	0.0004	0.116
4	1.18	0.0028	0.052	0.7683	16.39	0.051	33.9379	0.12	3.278	0.0046	0.04	42.70	0.00068	0.0051	0.00044	0.12
5	1.185	0.003	0.053	0.778	16.4198	0.052	33.96	0.12	3.28	0.0047	0.041	42.867	0.001	0.0051	0.0005	0.121
6	1.205	0.003	0.0536	0.78	16.499	0.053	34.01	0.12	3.28	0.0047	0.043	42.9133	0.0013	0.006	0.0006	0.124
7	1.219	0.003	0.0538	0.792	16.60	0.054	34.026	0.122	3.285	0.005	0.0434	43.29		0.00633	0.00066	0.125
8	1.22	0.0032	0.0541	0.794	16.6067	0.055	34.1633	0.123	3.29	0.0108	0.044	43.319		0.007	0.001	0.128
9	1.2228	0.0033	0.056	0.80	16.74	0.055	34.26	0.123	3.30	0.0108	0.044	43.33		0.007	0.0013	0.15
10	1.268		0.056	0.80	16.75	0.056	34.76	0.1239	3.33		0.044	43.44		0.0072	0.0014	0.154
11	1.321			0.81	17.05	0.06	36.00	0.13	3.3309					0.009		0.16
12						0.0639	36.60	0.13	3.37							
13						0.0673										
14																
Mean	1.2	0.0028	0.052	0.777	16.6	0.053	34.4	0.122	3.29	0.006	0.04	42.9	0.0006	0.006	0.0007	0.13
STDV.	0.06	0.0004	0.005	0.03	0.2	0.009	0.9	0.005	0.04	0.003	0.004	0.5	0.0004	0.002	0.0004	0.02
Certified	1.20	0.0028	0.052	0.777	16.6	0.053	34.4	0.122	3.29	0.006	0.040	42.9	0.0006	0.006	0.0007	0.13
U _{CRM}	0.04	0.0003	0.003	0.02	0.2	0.006	0.6	0.003	0.02	0.002	0.003	0.4	0.0005	0.001	0.0003	0.01
Methods	O,X,I,G	O,I,IM,G	C	O,X,I,G	X,W,O,G,I	O,X,I,G,IM	O,X,I,G	O,X,I,G,IM	O,X,I,G	F	O,X,G,IM	O,X,I	F	O,I,X,G,IM	C,G	O,X,I,G,IM

	Ti	V	W	Zr	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Cl	Cs
1	1.15	0.01	0.0237	0.012	<0.0001	0.0013	<0.00001	<0.000005	<0.000005	<0.000005	<0.000005	0.00002	0.0083	<0.000005	<0.000001	<0.000001
2	1.158	0.012	0.027	0.016	<0.0005	<0.005						<0.005	<0.0005			
3	1.16333	0.015	0.033	0.0165						<0.0001	<0.001					
4	1.168	0.016	0.034	0.019												
5	1.17	0.016	0.039	0.019												
6	1.172	0.016	0.04	0.02												
7	1.18	0.017	0.04	0.023												
8	1.193	0.017	0.041	0.0232												
9	1.20	0.018	0.042													
10	1.2123	0.021	0.05													
11	1.214	0.03	0.05													
12		0.0322														
13																
14																
Mean	1.18	0.018	0.038	0.019												
STDV.	0.02	0.007	0.008	0.004												
Certified	1.18	0.018	0.038	0.019	<0.0005	<0.005	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.005	<0.009	<0.0001	<0.0001	<0.0001
U _{CRM}	0.01	0.004	0.006	0.003												
Methods	O,X,I,G	O,X,G,IM	O,X,G,IM	O,I,G,X,IM	IM,G	IM,G	G	G	G	IM,G	G	IM,G	IM,G	G	G	G

	Dy	Er	Eu	F	Ga	Gd	Ge	H	Hf	Hg	Ho	I	In	Ir	K	La
1	<0.000001	<0.000001	<0.000001	<0.00001	0.0011	<0.000001	0.00021	0.0002	0.00081	<0.00001	<0.000001	<0.000001	<0.00001	0.00006	<0.000005	<0.000001
2									0.001							
3									0.001							
4									0.01							
5									0.0446							
6																
Mean																
STDV.																
Certified	<0.0001	<0.0001	<0.0001	<0.0001	<0.002	<0.0001	<0.0003	<0.0003	<0.05	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Methods	G	G	G	G	G	G	G	F	O,X,IM,G	G	G	G	G	G	G	G

	Li	Lu	Mg	Na	Nd	Os	Pb	Pd	Pr	Pt	Rb	Re	Rh	Ru	Sb	Sc
1	<0.0000005	<0.000001	0.00022	<0.000001	<0.000001	0.000006	0.000013	0.000039	<0.000001	<0.00001	<0.0001	0.000007	<0.00001	<0.00001	0.00018	<0.000005
2			0.00036				0.001	<0.001							0.00018	
3			0.0006				0.0077								<0.001	
4			0.002				<0.0001									
5			0.0023				<0.001									
6			<0.001													
Mean																
STDV.																
Certified	<0.0001	<0.0001	<0.003	<0.0001	<0.0001	<0.0001	<0.008	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001
Methods	G	G	O,G,IM	G	G	G	O,IM,G	IM,G	G	G	G	G	G	G	IM,G	G

	Se	Sm	Sn	Sr	Ta	Tb	Te	Th	Tl	Tm	U	Y	Yb	Zn
1	0.00039	<0.000001	0.00025	<0.0005	0.00014	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	0.000003	<0.0005	<0.000001	0.0002
2	<0.0002		0.00037		0.008							<0.001		0.0034
3	<0.005		0.003		0.01									<0.001
4			0.0063		0.012									
5			<0.001		0.0234									
6														
Mean														
STDV.														
Certified	<0.005	<0.0001	<0.007	<0.0001	<0.03	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.004
Methods	IM,G	G	O,IM,G	G	O,X,IM,G	G	G	G	G	G	G	IM,G	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

Oxford Instruments Analytical GmbH
Laboratory Testing, Inc.
ATI Specialty Materials, Lockport
Anderson Laboratories, Inc.
ATI Specialty Materials, Monroe
NSL Analytical Services, Inc.

Uedem, Germany
Hatfield, PA
Lockport, NY
Greendale, WI
Monroe, NC
Cleveland, OH

Huntington Alloys Corporation
Latrobe Specialty Metals, A Carpenter Co.
Laboratorio Prove Materiali S. Marco srl
LECO Corporation
LGC Standards
EAG Laboratories

Huntington, WV
Latrobe, PA
Schio, Italy
St. Joseph, MI
Manchester, NH
Liverpool, NY

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 202A IARM 203A IARM 52B IARM 59E IARM 62D NIST 1191 NIST 1247 NIST 161 NIST 3106 NIST 3128 NIST 3151 NIST 3169 NIST 864

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

