

Certificate of Analysis

IARM Ni825-18

Nickel Alloy 825 / UNS N08825

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.11 ± 0.01	B	0.0023 ± 0.0004	C	0.006 ± 0.003	Co	0.55 ± 0.02
Cr	22.4 ± 0.2	Cu	1.81 ± 0.03	Fe	29.5 ± 0.4	Mn	0.49 ± 0.01
Mo	2.80 ± 0.05	N	0.0093 ± 0.0006	Nb	0.31 ± 0.01	Ni	40.8 ± 0.4
O	0.0020 ± 0.0009	P	0.013 ± 0.002	Si	0.17 ± 0.02	Sn	0.0023 ± 0.0004
Ta	0.0011 ± 0.0005	Ti	0.96 ± 0.02	V	0.047 ± 0.003	W	0.230 ± 0.009
Zr	0.002 ± 0.002						

Indicative Values listed in ppm

Ag (<1)	As (20)	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 (30)	Gd (<1)	Ge (<10)	H (<7)	Hf (<50)
Hg (<1)	Ho (<1)	I (<1)	In (<1)	Ir (<1)	K (<1)	La (<1)
Li (<1)	Lu (<1)	Mg (2)	Na (<1)	Nd (<1)	Os (<1)	Pb (<10)
Pd (<10)	Pr (<1)	Pt (<1)	Rb (<1)	Re (39)	Rh (<1)	Ru (<1)
S (30)	Sb (40)	Sc (<1)	Se (<50)	Sm (<1)	Sr (<5)	Tb (<1)
Te (<1)	Th (<1)	Tl (<1)	Tm (<1)	U (<1)	Y (<10)	Yb (<1)
Zn (<10)						

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	Mn	Mo	N	Nb	Ni	O	P	Si	Sn
1	0.084	0.00187	0.0035	0.5053	22.10	1.7605	28.8367	0.462	2.67	0.00803	0.268	40.36	0.0012	0.0087	0.12567	0.00183
2	0.0887	0.0019	0.00375	0.52	22.14	1.769	29.13	0.469	2.71	0.00828	0.29333	40.459	0.0013	0.00905	0.1263	0.002
3	0.0971	0.00193	0.0039	0.5237	22.28	1.77	29.3167	0.47575	2.753	0.0091	0.2995	40.943	0.0015	0.01145	0.15233	0.00207
4	0.098	0.002	0.004	0.542	22.325	1.778	29.343	0.4763	2.783	0.0092	0.302	41.00	0.0015	0.01243	0.15825	0.0024
5	0.110	0.0021	0.004	0.5477	22.3463	1.79	29.43	0.4784	2.802	0.00933	0.30567	41.07	0.0016	0.0129	0.1651	0.0024
6	0.1104	0.0024	0.00555	0.56	22.42667	1.824	29.46	0.479	2.81	0.0095	0.3092	41.2335	0.00316	0.013	0.17	0.0029
7	0.115	0.00296	0.01082	0.5635	22.501	1.827	29.4656	0.4862	2.8113	0.00954	0.31		0.00368	0.013	0.1768	
8	0.115	0.003	0.012	0.571	22.6533	1.8323	29.6298	0.488	2.84	0.01	0.31			0.015	0.18	
9	0.115			0.5713	22.79	1.846	29.6688	0.49	2.868	0.01051	0.3342			0.016	0.183	
10	0.13			0.5792		1.847	30.71	0.507	2.917		0.336			0.01647	0.193	
11	0.143			0.613		1.914		0.51						0.0184	0.2045	
12	0.1482							0.549							0.21	
13																
14																
15																
Mean	0.11	0.0023	0.006	0.55	22.4	1.81	29.5	0.49	2.8	0.0093	0.31	40.8	0.002	0.013	0.17	0.0023
STDV.	0.02	0.0005	0.003	0.03	0.2	0.05	0.5	0.02	0.07	0.0008	0.02	0.4	0.001	0.003	0.03	0.0004
Certified	0.11	0.0023	0.006	0.55	22.4	1.81	29.5	0.49	2.80	0.0093	0.31	40.8	0.0020	0.013	0.17	0.0023
U _{CRM}	0.01	0.0004	0.003	0.02	0.2	0.03	0.4	0.01	0.05	0.0006	0.01	0.4	0.0009	0.002	0.02	0.0004
Methods	I,O,G,X	I,O,G	C,O	I,O,G,X	I,O,X	I,O,X	I,O,X	I,O,G,X	I,O,X	F,C,O	I,O,G,X	I,O,X	F,C	IM,I,O,G,X	IM,I,O,G,X	IM,I,O,G

	Ta	Ti	V	W	Zr	Ag	As	Au	Ba	Be	Bi	Br	Ca	Cd	Ce	Cl
1	0.0003	0.8998	0.04025	0.209	0.00008	0.000034	0.0015	<0.00001	<0.000005	<0.000005	0.000001	<0.000005	0.000016	<0.00002	<0.000005	0.0000017
2	0.00098	0.92	0.042	0.21	0.00009	<0.00005	0.0015	<0.00005	<0.00003	<0.00001	<0.000005	<0.000005	0.000033	<0.001	<0.00001	<0.000001
3	0.001	0.945	0.045	0.225	0.00022		0.00224				<0.0001	<0.00005	<0.001	<0.001	<0.00001	<0.000001
4	0.0013	0.945	0.0458	0.2261	0.0005		0.0026				<0.001	<0.00005	<0.001	<0.001	<0.00001	<0.000001
5	0.00159	0.96	0.04677	0.2273	0.000995		<0.001				<0.001	<0.00005	<0.001	<0.001	<0.00001	<0.000001
6	0.001633	0.969	0.0474	0.232	0.005		<0.005									
7		0.97167	0.048	0.232	0.0057											
8		0.973	0.0482	0.2333												
9		0.9733	0.0501	0.24												
10		0.9772	0.0538	0.2456												
11		1.0067	0.25													
12																
13																
14																
15																
Mean	0.0011	0.96	0.047	0.23	0.002		0.0020									
STDV.	0.0005	0.03	0.004	0.01	0.002		0.0006									
Certified	0.0011	0.96	0.047	0.230	0.002	<0.0001	(0.002)	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.005	<0.005	<0.0001	<0.0001
U _{CRM}	0.0005	0.02	0.003	0.009	0.002											
Methods	IM,I,O,G	I,O,X	IM,I,O,G,X	IM,I,O,G,X	IM,I,O,G	IM,G	IM,I,G	IM,G	IM,G	IM,G	IM,I,G	IM,G	IM,I,G	IM,I,G	IM,G	IM,G

	Cs	Dy	Er	Eu	F	Ga	Gd	Ge	H	Hf	Hg	Ho	I	In	Ir	K
1	<0.000001	<0.000001	<0.000001	<0.000001	<0.00001	0.0021	<0.000001	0.00044	0.0004	<0.000001	<0.000001	<0.000001	<0.000001	0.000031	0.000016	0.000012
2	<0.00001	<0.000005	<0.000005	<0.000005	<0.00001	0.0029	<0.000005	0.001	0.000667	<0.00001	<0.00005	<0.000005	<0.00001	<0.00002	<0.00001	<0.000005
3										<0.001						
4										<0.005						
5																
6																
7																
8																
9																
10																
Mean						0.0030		0.0010	0.0010							
STDV.						0.0006		0.0004	0.0002							
Certified	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	(0.003)	<0.0001	<0.001	<0.0007	<0.005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
U _{CRM}																
Methods	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	F	IM,I,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G

	La	Li	Lu	Mg	Na	Nd	Os	Pb	Pd	Pr	Pt	Rb	Re	Rh	Ru	S
1	<0.000001	<0.000005	<0.000001	0.00019	0.000006	<0.000001	0.000015	0.000021	0.000012	<0.000001	0.000011	<0.0001	0.000369	<0.00001	<0.00001	0.00021
2	<0.00001	<0.00001	<0.000005	0.0002	<0.000001	<0.000005	<0.00001	0.000035	<0.00005	<0.000005	<0.00001	<0.0001	0.0004	<0.00001	<0.00001	0.00028
3				0.000297				0.0000833	<0.001				0.00041			0.0016
4				<0.0005				0.0162					<0.005			0.00275
5				<0.001				<0.001								0.01051
6				<0.001				<0.001								<0.0005
7				<0.005												<0.0005
8																<0.0005
9																<0.001
10																<0.001
Mean				0.00020									0.00039			0.003
STDV.				0.00006									0.00002			0.004
Certified	<0.0001	<0.0001	<0.0001	(0.0002)	<0.0001	<0.0001	<0.0001	<0.001	<0.001	<0.0001	<0.0001	<0.0001	(0.00039)	<0.0001	<0.0001	(0.003)
U _{CRM}																
Methods	IM,G	IM,G	IM,G	IM,I,G	IM,G	IM,G	IM,G	IM,I,G	IM,I,G	IM,G	IM,G	IM,G	IM,I,G	IM,G	IM,G	C,I,O,G,X

	Sb	Sc	Se	Sm	Sr	Tb	Te	Th	Tl	Tm	U	Y	Yb	Zn
1	0.0002567	<0.000005	<0.00005	<0.000001	<0.000020	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	<0.000001	0.00049	<0.000001	0.00012
2	0.000366	<0.00001	<0.0002	<0.000005	<0.0005	<0.000005	<0.00001	<0.000001	<0.000005	<0.000005	<0.000001	<0.00010	<0.000005	0.00015
3	0.0004		<0.001									<0.0005		<0.001
4	0.0004		<0.005									<0.001		<0.001
5	0.00044													
6	<0.001													
7														
8														
9														
Mean	0.0004													0.00010
STDV.	0.0001													0.00002
Certified	(0.0004)	<0.0001	<0.005	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.001
U _{CRM}														
Methods	IM,I,G	IM,G	IM,I,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,G	IM,I,G	IM,G	IM,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



Certification Laboratories

Connecticut Metallurgical, Inc.
Dirats Laboratories
IMR Test Labs
NSL Analytical Services, Inc.
Northern Analytical Laboratory, Inc.

East Hartford, CT
Westfield, MA
Lansing, NY
Cleveland, OH
Londonderry, NH

Massachusetts Materials Research, Inc.
EAG Laboratories, Inc.
Haynes International, Inc.
Kennametal Stellite, Inc.
VHG Labs

West Boylston, MA
Liverpool, NY
Kokomo, IN
Belleville, ON
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 1249 NIST 345 NIST 349A NIST 361 NIST 362 NIST 363 NIST 364 NIST1194 IARM 347A IARM 55B IARM 56A IARM 62C

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.



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