Certified Reference Material | Certificate of Analysis

ISO 17034:2016 ISO/IEC 17025:2017 ISO 9001:2015

Product ID: IARM-Ni800-18

Product Description: Nickel Alloy, Alloy 800 / N08800

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** accredited laboratories. This CRM may come in the form of a solid disk, 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.

Certified Values listed in wt.% with associated uncertainties

Al	0.421	± 0.006	B	0.0025	± 0.0003	C	0.070	± 0.002	Co	0.023	± 0.002
Cr	19.38	± 0.09	Cu	0.068	± 0.004	Fe	47.2	± 0.2	Mn	0.61	± 0.02
Mo	0.033	± 0.003	N	0.0087	± 0.0005	Ni	31.3	± 0.2	O	0.002	± 0.001
P	0.013	± 0.002	Pb	0.0003	± 0.0001	S	0.0012	± 0.0003	Sb	0.0011	± 0.0008
Si	0.42	± 0.02	Sn	0.0017	±0.0004	Ti	0.520	± 0.008	V	0.028	± 0.001
Zr	0.0013	± 0.0006									

Indicative Values listed in ppm

As	(<50)	Mg	(<50)	Nb	(70)	W	(100)

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 calculated 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.

$$1.\ N_{MIN} = \max\left(10, \sqrt[3]{N_{PROD}}\right) \qquad\qquad 2.\ U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

Certification Laboratories: Much of the analytical work performed to assess this material has been carried out by laboratories with proven competence, as indicated by their accreditation to ISO 17025. It is an implicit requirement for this accreditation that analytical work should be performed with due traceability, via an unbroken chain of comparisons, each with stated uncertainty, to primary standards such as the mole, or to nationally- or internationally-recognised reference materials. Of the individual results herein, some have traceability (to the mole) via primary analytical methods. Some are traceable to substances of known stoichiometry. Most have traceability via commercial solutions. Furthermore, some results have additional traceability to NIST standards, as part of the analytical calibration or process control.

- LGC Standards-Manchester, NH
- Connecticut Metallurgical, Inc.-East Hartford, CT
- Dirats Laboratories-Westfield, MA
- IMR Test Labs-Lansing, NY
- Laboratory Testing, Inc.-Hatfield, PA
- NSL Analytical Services-Cleveland, OH
- SGS MSi-Melrose Park, IL
- Applied Technical Services-Marietta, GA
- EAG Laboratories-Liverpool, NY
- Sheffield Assay Office-Sheffield, UK
- Scrooby's Laboratory Service-Rynfield, South Africa
- Element Materials Technology-Middlesbrough, UK
- New Hampshire Materials Laboratory-Somersworth, NH
- RSML-Bengaluru, India
- TEC Eurolab-Campogalliano, Italy
- TCR Engineering Services-Maharashtra, India
- Lucid Laboratories-Telangana, India

Instructions for Use: 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. 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 recommended for gas analysis.

Period of Validity: 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.

Kimberly Halkiotis, **Global Product Manager**

February 1, 2022
Certification Date

Conditions of Sale and Supply: All CRMs & RMs sold are subject to applicable LGC Standard Terms and Conditions of Sale.

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

Lab	Al	As	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	N	Nb	Ni
1	0.3950	0.0019	0.0019	0.0600	0.0117	18.900	0.0530	46.830	0.0015	0.5473	0.0207	0.0077	0.0020	30.504
2	0.4020	0.0044	0.0019	0.0616	0.0160	19.144	0.0585	46.880	0.0040	0.5540	0.0262	0.0080	0.0030	30.660
3	0.4100	<0.005	0.0019	0.0640	0.0170	19.170	0.0586	46.900	<0.005	0.5568	0.0270	0.0080	0.0031	30.900
4	0.4100		0.0020	0.0650	0.0180	19.190	0.0651	47.000		0.5600	0.0295	0.0080	0.0031	30.950
5	0.4131		0.0020	0.0680	0.0200	19.250	0.0660	47.013		0.5680	0.0308	0.0083	0.0034	30.982
6	0.4139		0.0021	0.0690	0.0201	19.283	0.0690	47.028		0.6159	0.0310	0.0086	0.0041	31.025
7	0.4163		0.0024	0.0699	0.0212	19.313	0.0700	47.030		0.6160	0.0311	0.0089	0.0042	31.066
8	0.4170		0.0025	0.0700	0.0215	19.320	0.0710	47.152		0.6200	0.0322	0.0091	0.0055	31.140
9	0.4176		0.0025	0.0705	0.0220	19.330	0.0720	47.232		0.6257	0.0330	0.0094	0.0058	31.220
10	0.4198		0.0025	0.0710	0.0225	19.400	0.0728	47.295		0.6260	0.0331	0.0095	0.0080	31.250
11	0.4200		0.0027	0.0714	0.0239	19.440	0.0729	47.320		0.6301	0.0340	0.0100	0.0090	31.261
12	0.4230		0.0029	0.0720	0.0240	19.460	0.0740	47.520		0.6304	0.0343		0.0090	31.283
13	0.4320		0.0030	0.0721	0.0250	19.487	0.0747	47.640		0.6310	0.0350		0.0100	31.362
14	0.4339		0.0030	0.0722	0.0253	19.500	0.0758	48.060		0.6321	0.0355		0.0104	31.397
15	0.4340		0.0030	0.0726	0.0258	19.500				0.6370	0.0356		0.0110	31.400
16	0.4350		0.0032	0.0730	0.0260	19.533				0.6400	0.0374		0.0120	31.470
17	0.4358		0.0034	0.0740	0.0260	19.545				0.6480	0.0400		0.0140	31.540
18	0.4390		<0.005	0.0742	0.0260	19.560				0.6500	0.0422		<0.005	31.550
19	0.4400			0.0780	0.0265	19.580				0.6500			<0.01	31.602
20					0.0320	19.670				0.6520			<0.01	31.620
21					0.0330									31.650
22														31.800
23														32.000
Mean	0.4214	0.0032	0.0025	0.0699	0.0230	19.379	0.0681	47.207	0.0028	0.6145	0.0327	0.0087	0.0069	31.288
STDV	0.0129	0.0018	0.0005	0.0045	0.0050	0.1865	0.0070	0.3424	0.0018	0.0357	0.0050	0.0008	0.0037	0.3579
Certified	**0.421**	**(<0.005)**	**0.0025**	**0.070**	**0.023**	**19.38**	**0.068**	**47.2**	**(<0.005)**	**0.61**	**0.033**	**0.0087**	**(0.007)**	**31.3**
U$_{CRM}$	0.006		0.0003	0.002	0.002	0.09	0.004	0.2		0.02	0.003	0.0005		0.2
Methods	I,O,X	I,X	I,O,IM	C,O,G	I,O,IM,X ,G,AA	O,I,X,G	I,IM,O,X ,G	O,I,X,W	I	I,O,X,G, AA	I,O,IM,X	F,O	IM,O,I,X ,G	I,O,X,W, G

Lab	O	P	Pb	S	Sb	Si	Sn	Ti	V	W	Zr
1	0.0003	0.0050	0.0001	0.0005	0.0002	0.3280	0.0010	0.4850	0.0240	0.0009	0.0003
2	0.0005	0.0060	0.0001	0.0007	0.0003	0.3705	0.0010	0.4905	0.0244	0.0017	0.0004
3	0.0006	0.0060	0.0002	0.0008	0.0003	0.3770	0.0011	0.4990	0.0257	0.0030	0.0006
4	0.0008	0.0098	0.0003	0.0010	0.0006	0.3853	0.0013	0.5000	0.0271	0.0030	0.0008
5	0.0021	0.0100	0.0004	0.0011	0.0012	0.3880	0.0014	0.5080	0.0279	0.0033	0.0010
6	0.0030	0.0100	0.0004	0.0012	0.0016	0.4010	0.0015	0.5080	0.0280	0.0040	0.0010
7	0.0030	0.0104	0.0004	0.0012	0.0024	0.4090	0.0016	0.5090	0.0288	0.0041	0.0011
8	0.0035	0.0113	<0.001	0.0012	0.0025	0.4160	0.0016	0.5177	0.0290	0.0042	0.0015
9	<0.0001	0.0120	<0.0010	0.0012	<0.001	0.4180	0.0020	0.5190	0.0292	0.0048	0.0021
10	<0.001	0.0120	<0.0010	0.0015	<0.0010	0.4200	0.0020	0.5200	0.0296	0.0062	0.0027
11	<0.002	0.0125	<0.002	0.0017	<0.0010	0.4302	0.0024	0.5200	0.0299	0.0062	0.0030
12		0.0131	<0.002	0.0020	<0.0010	0.4310	0.0031	0.5200	0.0300	0.0093	<0.0005
13		0.0140	<0.002	0.0020	<0.002	0.4323	<0.001	0.5220	0.0307	0.0101	<0.0010
14		0.0140	<0.002	<0.0005		0.4410	<0.001	0.5228	0.0308	0.0350	<0.002
15		0.0144	<0.005	<0.0005		0.4430	<0.0010	0.5260	0.0323	0.0400	<0.0020
16		0.0151		<0.001		0.4450	<0.002	0.5270		0.0459	<0.005
17		0.0151		<0.002		0.4480	<0.002	0.5285		<0.001	<0.01
18		0.0155		<0.002		0.4600	<0.002	0.5338		<0.005	
19		0.0160		<0.002		0.4660	<0.005	0.5392		<0.01	
20		0.0170		<0.003		0.5079	<0.01	0.5400			
21		0.0190						0.5460			
22		0.0220						0.5496			
23											
Mean	0.0017	0.0127	0.0003	0.0012	0.0011	0.4209	0.0017	0.5196	0.0285	0.0114	0.0013
STDV	0.0013	0.0042	0.0001	0.0005	0.0009	0.0395	0.0006	0.0169	0.0024	0.0147	0.0009
Certified	**0.002**	**0.013**	**0.0003**	**0.0012**	**0.0011**	**0.42**	**0.0017**	**0.520**	**0.028**	**(0.01)**	**0.0013**
U$_{CRM}$	0.001	0.002	0.0001	0.0003	0.0008	0.02	0.0004	0.008	0.001		0.0006
Methods	F	I,O,IM,X, G,W	I,IM,O,X ,AA	C,I,X,O	IM,O,X, AA	I,O,X,G	I,IM,O,X	I,O,X,G	O,IM,I,X ,G	I,IM,O,X	I,IM,O,X

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

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