

**Certified Reference Material**

**Certificate of Analysis**

**Product ID:** IARM-Ni800-19

ISO  
17034:2016

ISO/IEC  
17025:2017

ISO  
9001:2015

**Product Description:** Nickel Alloy, Alloy 800 / N08800

Revision No.: 000  
Revision Date: 02/25/2022

**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											
<b>Al</b>	<b>0.44</b>	± 0.01	<b>B</b>	<b>0.0004</b>	± 0.0002	<b>C</b>	<b>0.079</b>	± 0.002	<b>Co</b>	<b>0.0027</b>	± 0.0008
<b>Cr</b>	<b>20.13</b>	± 0.06	<b>Cu</b>	<b>0.0039</b>	± 0.0008	<b>Fe</b>	<b>47.04</b>	± 0.09	<b>Mn</b>	<b>0.662</b>	± 0.009
<b>N</b>	<b>0.0070</b>	± 0.0006	<b>Ni</b>	<b>30.9</b>	± 0.1	<b>O</b>	<b>0.0041</b>	± 0.0006	<b>P</b>	<b>0.0021</b>	± 0.0006
<b>S</b>	<b>0.0016</b>	± 0.0002	<b>Si</b>	<b>0.34</b>	± 0.02	<b>Ti</b>	<b>0.497</b>	± 0.005	<b>V</b>	<b>0.0083</b>	± 0.0009
<b>Zr</b>	<b>0.0014</b>	± 0.0006									

Indicative Values listed in ppm							
Ag (1.5)	As (10)	Bi (<20)	Ca (30)	Cd (<100)	Hf (<100)	La (<100)	
Mg (10)	Mo (60)	Nb (50)	Pb (3)	Re (<30)	Sb (<20)	Sn (13)	
Ta (40)	W (30)	Y (<10)					

**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.

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

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

**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-recognized 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
- 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 Halkotis, Global Product Manager

February 25, 2022  
Certification Date



ISO 17034 Accredited: Reference Materials  
Producer, Certificate # 2848.02  
ISO/IEC 17025 Accredited: Chemical  
Testing, Certificate # 2848.01

**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.

	Ag	Al	As	B	Bi	C	Ca	Cd	Co	Cr	Cu	Fe	Hf
1	0.0001	0.4049	0.0001	0.0001	<0.00005	0.0684	0.0006	0.0004	0.0008	19.919	0.0018	46.800	0.0006
2	0.0001	0.4100	0.0001	0.0002	<0.0001	0.0700	0.0008	0.0010	0.0011	19.970	0.0022	46.803	0.0149
3	0.0002	0.4164	0.0010	0.0002	<0.0001	0.0730	0.0011	0.0080	0.0023	20.000	0.0022	46.919	0.0210
4	0.0002	0.4219	0.0017	0.0002	<0.001	0.0730	0.0022	<0.00005	0.0025	20.000	0.0028	46.960	<0.00005
5	<0.00005	0.4350	0.0018	0.0002	<0.0010	0.0760	0.0028	<0.0005	0.0026	20.050	0.0030	46.977	<0.0001
6	<0.0001	0.4378	0.0020	0.0003	<0.0010	0.0764	0.0050	<0.0005	0.0030	20.061	0.0030	46.980	<0.0005
7	<0.0002	0.4380	0.0031	0.0004	<0.0010	0.0803	0.0053	<0.001	0.0031	20.080	0.0030	47.030	<0.0010
8	<0.0010	0.4400	<0.0005	0.0005	<0.0010	0.0804	0.0069	<0.001	0.0032	20.080	0.0037	47.030	<0.0010
9	<0.0010	0.4401	<0.0005	0.0005	<0.002	0.0810	<0.0005	<0.0010	0.0040	20.101	0.0037	47.100	<0.002
10		0.4409	<0.002	0.0008	<0.002	0.0813	<0.001	<0.0010	0.0043	20.121	0.0040	47.148	<0.01
11		0.4420	<0.002	0.0009	<0.002	0.0817	<0.0010	<0.0010	<0.0005	20.176	0.0041	47.200	
12		0.4480	<0.002	0.0010	<0.0020	0.0818	<0.0010	<0.0010	<0.002	20.190	0.0045	47.208	
13		0.4520	<0.005	<0.0001		0.0820	<0.002	<0.01	<0.002	20.210	0.0050	47.210	
14		0.4570		<0.0005		0.0820	<0.002		<0.002	20.227	0.0060	47.240	
15		0.4582		<0.001		0.0828	<0.002		<0.01	20.247	0.0060		
16		0.4660		<0.001		0.0830	<0.01			20.290	0.0076		
17		0.4700		<0.001		0.0845				20.330	<0.0005		
18		0.4710				0.0845				20.370	<0.001		
19											<0.001		
20											<0.001		
21											<0.01		
22													
Mean	0.0002	0.4416	0.0014	0.0004		0.0790	0.0031	0.0031	0.0027	20.135	0.0039	47.043	0.0122
STDV	0.0001	0.0194	0.0011	0.0003		0.0050	0.0024	0.0042	0.0011	0.1282	0.0016	0.1468	0.0105
<b>Certified</b>	<b>(0.00015)</b>	<b>0.44</b>	<b>(0.001)</b>	<b>0.0004</b>	<b>(&lt;0.002)</b>	<b>0.079</b>	<b>(0.003)</b>	<b>(&lt;0.01)</b>	<b>0.0027</b>	<b>20.13</b>	<b>0.0039</b>	<b>47.04</b>	<b>(&lt;0.01)</b>
U <sub>CRM</sub>		0.01		0.0002		0.002			0.0008	0.06	0.0008	0.09	
Methods	O,IM,A,X	I,X,O,G,IM	X,O,I,IM	I,O,IM	IM,I,O,X	C,G,O	I,O,IM,A,X	I,O,IM,A,X	I,IM,O,A,X	I,X,O,G	I,X,IM,O,G,A	I,X,O,W	O,I,IM,X

	La	Mg	Mn	Mo	N	Nb	Ni	O	P	Pb	Re	S	Sb
1	<0.00005	0.0001	0.6390	0.0011	0.0056	0.0004	30.400	0.0034	0.0006	0.0001	<0.00005	0.0010	0.0002
2	<0.0001	0.0002	0.6390	0.0021	0.0060	0.0005	30.460	0.0035	0.0009	0.0001	<0.0005	0.0010	0.0020
3	<0.0002	0.0002	0.6410	0.0024	0.0060	0.0009	30.470	0.0038	0.0013	0.0001	<0.001	0.0012	<0.00005
4	<0.0005	0.0003	0.6440	0.0028	0.0067	0.0012	30.490	0.0039	0.0016	0.0001	<0.0010	0.0015	<0.0001
5	<0.0005	0.0010	0.6451	0.0030	0.0071	0.0015	30.505	0.0040	0.0020	0.0014	<0.0010	0.0015	<0.0005
6	<0.001	0.0010	0.6460	0.0034	0.0073	0.0050	30.603	0.0040	0.0020	<0.0001	<0.003	0.0015	<0.001
7	<0.001	0.0012	0.6482	0.0039	0.0074	0.0060	30.716	0.0047	0.0022	<0.0001	<0.0001	0.0017	<0.0010
8	<0.0010	0.0014	0.6580	0.0039	0.0076	0.0062	30.798	0.0055	0.0024	<0.0001	<0.0001	0.0017	<0.0010
9	<0.0010	0.0030	0.6594	0.0047	0.0077	0.0080	30.840		0.0025	<0.0010		0.0017	<0.0010
10	<0.0010	<0.0005	0.6630	0.0054	0.0080	0.0091	30.850		0.0029	<0.0010		0.0017	<0.0010
11	<0.01	<0.0005	0.6700	0.0060	0.0080	0.0100	30.885		0.0030	<0.002		0.0018	<0.002
12		<0.001	0.6700	0.0060		0.0100	30.923		0.0037	<0.002		0.0018	<0.002
13		<0.0010	0.6705	0.0061		0.0109	30.975		<0.0001	<0.002		0.0020	<0.002
14		<0.002	0.6710	0.0070		<0.0001	31.003		<0.0005	<0.002		0.0020	
15		<0.002	0.6810	0.0072		<0.0005	31.015		<0.0005			0.0021	
16		<0.01	0.6900	0.0100		<0.0010	31.080		<0.002			0.0021	
17			0.6910	0.0113		<0.0010	31.190		<0.002			<0.0010	
18			0.6951	0.0150		<0.002	31.200		<0.002			<0.003	
19				0.0190		<0.01	31.230		<0.005				
20				<0.001		<0.01	31.390		<0.0050				
21				<0.0010									
22				<0.01									
Mean		0.0009	0.6623	0.0063	0.0070	0.0054	30.851	0.0041	0.0021	0.0003		0.0016	0.0011
STDV		0.0009	0.0187	0.0046	0.0008	0.0040	0.2928	0.0007	0.0009	0.0006		0.0003	0.0013
<b>Certified</b>	<b>(&lt;0.01)</b>	<b>(0.001)</b>	<b>0.662</b>	<b>(0.006)</b>	<b>0.0070</b>	<b>(0.005)</b>	<b>30.9</b>	<b>0.0041</b>	<b>0.0021</b>	<b>(0.0003)</b>	<b>(&lt;0.003)</b>	<b>0.0016</b>	<b>(&lt;0.002)</b>
U <sub>CRM</sub>			0.009		0.0006		0.1	0.0006	0.0006			0.0002	
Methods	I,O,IM	I,O,IM,A,X	I,X,O,G,A	I,X,IM,O,G	F	I,X,IM,O,G	I,X,O,G,W	F	X,I,IM,O,W	IM,I,O,A,X	IM,I,O	I,X,C,G,O	IM,I,O,A,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

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

	Si	Sn	Ta	Ti	V	W	Y	Zr
1	0.3010	0.0010	0.0004	0.4800	0.0061	0.0001	<0.00005	0.0004
2	0.3026	0.0010	0.0008	0.4820	0.0065	0.0010	<0.0001	0.0004
3	0.3050	0.0011	0.0010	0.4840	0.0068	0.0012	<0.0002	0.0005
4	0.3080	0.0019	0.0018	0.4850	0.0070	0.0015	<0.0005	0.0010
5	0.3100	<0.00005	0.0030	0.4877	0.0073	0.0017	<0.0005	0.0010
6	0.3150	<0.0002	0.0080	0.4890	0.0073	0.0025	<0.001	0.0013
7	0.3160	<0.0005	0.0100	0.4900	0.0080	0.0025	<0.0010	0.0020
8	0.3161	<0.001	<0.00005	0.4903	0.0089	0.0030	<0.0010	0.0020
9	0.3190	<0.001	<0.0005	0.4920	0.0093	0.0030		0.0023
10	0.3203	<0.001	<0.0010	0.4978	0.0097	0.0062		0.0030
11	0.3252	<0.0010	<0.002	0.4988	0.0100	0.0072		<0.0005
12	0.3329	<0.0010	<0.01	0.5000	0.0102	0.0091		<0.001
13	0.3390	<0.0010		0.5000	0.0102	<0.0005		<0.0010
14	0.3410	<0.002		0.5020	<0.002	<0.001		<0.0010
15	0.3490	<0.002		0.5029	<0.01	<0.0010		<0.002
16	0.3520	<0.002		0.5050		<0.002		<0.0020
17	0.3760	<0.01		0.5090		<0.002		<0.01
18	0.3851			0.5134		<0.005		
19	0.4100			0.5140		<0.005		
20	0.4100			0.5180		<0.01		
21	0.4170							
22								
Mean	0.3405	0.0013	0.0036	0.4970	0.0083	0.0033		0.0014
STDV	0.0376	0.0004	0.0038	0.0112	0.0015	0.0028		0.0009
<b>Certified</b>	<b>0.34</b>	<b>(0.0013)</b>	<b>(0.004)</b>	<b>0.497</b>	<b>0.0083</b>	<b>(0.003)</b>	<b>(&lt;0.001)</b>	<b>0.0014</b>
U <sub>CRM</sub>	0.02			0.005	0.0009			0.0006
Methods	I,X,O,G,IM,W	X,I,O,IM	IM,O,I,X	I,X,O,G,IM	I,X,IM,O,G	X,I,O,G,IM	IM,I,O	I,X,IM,O