

Certified Reference Material

Certificate of Analysis

Product ID: IARM-NI718-22

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Nickel Alloy, Nickel Chromium Inconel,
High Temp Alloy 718 / N07718

Revision No.: 001
Revision Date: 09/27/2023

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	0.56	±0.01	Cu	0.059	±0.003	Nb	5.17	±0.04	Sn	0.0013	±0.0006
B	0.0047	±0.0004	Fe	18.4	±0.1	Ni	52.8	±0.3	Ta	0.0033	±0.0008
C	0.036	±0.001	Mn	0.071	±0.002	P	0.0088	±0.0008	Ti	0.91	±0.02
Co	0.253	±0.008	Mo	2.91	±0.02	S	0.0005	±0.0004	V	0.035	±0.002
Cr	18.46	±0.09	N	0.0079	±0.0004	Si	0.108	±0.006	W	0.049	±0.005

Indicative Values listed in ppm

O 20 Zr 31

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.

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

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.

- Anderson Laboratories, Inc. - Greendale, WI
- Applied Technical Services - Marietta, GA
- Dirats Laboratories - Westfield, MA
- EAG Laboratories - Liverpool, NY
- Elemental Analysis Inc. - Lexington, KY
- IMR Test Labs - Lansing, NY
- Laboratory Testing, Inc. - Hatfield, PA
- LGC Standards - Manchester, NH
- New Hampshire Materials Laboratory Inc - Somersworth, NH
- NSL Analytical Services - Cleveland, OH
- Scrooby's Laboratory Service Pty Ltd - Benoni, South Africa
- SGS MSI - Melrose Park, IL
- TEC Eurolab - Campogalliano, Italy

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.

Chuck Goudreau

Chuck Goudreau, Certifying Officer

July 14, 2023
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.

	Al	B	C	Co	Cr	Cu	Fe	Mn	Mo	N	Nb	Ni	O
1	0.4960	0.0035	0.0330	0.2280	18.19	0.0499	17.84	0.0653	2.831	0.0068	5.061	52.34	0.0011
2	0.5440	0.0040	0.0330	0.2310	18.20	0.0523	18.16	0.0653	2.853	0.0075	5.070	52.38	0.0023
3	0.5514	0.0042	0.0344	0.2428	18.30	0.0532	18.20	0.0656	2.859	0.0077	5.080	52.67	0.0025
4	0.5530	0.0042	0.0356	0.2440	18.31	0.0540	18.20	0.0660	2.866	0.0079	5.112	52.68	
5	0.5534	0.0043	0.0358	0.2447	18.33	0.0548	18.26	0.0670	2.868	0.0080	5.122	52.87	
6	0.5570	0.0044	0.0359	0.2500	18.36	0.0573	18.28	0.0678	2.869	0.0080	5.129	52.87	
7	0.5600	0.0045	0.0361	0.2500	18.38	0.0579	18.37	0.0680	2.875	0.0080	5.161	52.90	
8	0.5610	0.0046	0.0368	0.2520	18.40	0.0580	18.38	0.0710	2.877	0.0083	5.162	52.96	
9	0.5640	0.0048	0.0370	0.2531	18.41	0.0589	18.44	0.0720	2.901	0.0083	5.167	53.65	
10	0.5660	0.0050	0.0372	0.2532	18.42	0.0604	18.47	0.0720	2.905	0.0090	5.193		
11	0.5670	0.0050	0.0376	0.2540	18.42	0.0610	18.50	0.0724	2.907		5.195		
12	0.5670	0.0052	0.0388	0.2547	18.43	0.0620	18.50	0.0726	2.909		5.200		
13	0.5730	0.0060		0.2550	18.50	0.0630	18.52	0.0745	2.918		5.209		
14	0.5751	0.0061		0.2600	18.56	0.0657	18.53	0.0750	2.920		5.237		
15	0.5790	<0.005		0.2620	18.67	0.0660	18.60	0.0760	2.934		5.305		
16	0.5817	<0.01		0.2810	18.74	0.0680	18.61	0.0760	2.940		5.319		
17	0.6180	<0.01		0.2900	18.75	0.0686	18.69	0.0764	2.950				
18					18.85		18.69		2.997				
19							18.85		3.030				
Avg	0.5627	0.0047	0.0359	0.2533	18.46	0.0595	18.42	0.0708	2.906	0.0079	5.170	52.81	0.0020
SD	0.0239	0.0007	0.0018	0.0152	0.19	0.0056	0.2341	0.0041	0.050	0.0006	0.076	0.39	0.0008
Certified	0.56	0.0047	0.036	0.253	18.46	0.059	18.4	0.071	2.91	0.0079	5.17	52.8	(0.0020)
Uncertainty	0.01	0.0004	0.001	0.008	0.09	0.003	0.1	0.002	0.02	0.0004	0.04	0.3	
Methods	I,O,X	I,IM,G,O	C	I,IM,O,X	I,G,O,X	I,IM,G,O,X	I,G,O,X	I,IM,G,O,X	I,G,O,X	F	I,G,O,X	I,O,X	F

	P	S	Si	Sn	Ta	Ti	V	W	Zr
1	0.0060	0.0002	0.0880	0.0005	0.0018	0.8730	0.0283	0.0340	0.0003
2	0.0062	0.0002	0.0890	0.0007	0.0027	0.8750	0.0316	0.0380	0.0003
3	0.0073	0.0003	0.0940	0.0009	0.0029	0.8870	0.0336	0.0399	0.0003
4	0.0078	0.0004	0.0950	0.0011	0.0036	0.8890	0.0337	0.0440	0.0010
5	0.0080	0.0005	0.0955	0.0014	0.0036	0.8907	0.0344	0.0452	0.0030
6	0.0080	0.0012	0.1020	0.0014	0.0039	0.8930	0.0358	0.0466	0.0045
7	0.0081	<0.0002	0.1040	0.0021	0.0043	0.8980	0.0360	0.0467	0.0046
8	0.0083	<0.0005	0.1040	0.0024	<0.002	0.8994	0.0362	0.0486	0.0050
9	0.0088	<0.001	0.1090	<0.002	<0.002	0.9020	0.0364	0.0490	0.0090
10	0.0088	<0.001	0.1130	<0.002	<0.002	0.9055	0.0365	0.0490	<0.0005
11	0.0095	<0.0010	0.1150	<0.002	<0.005	0.9100	0.0370	0.0527	<0.005
12	0.0099		0.1160	<0.005	<0.005	0.9113	0.0387	0.0530	
13	0.0100		0.1180	<0.005	<0.01	0.9130	<0.01	0.0542	
14	0.0102		0.1191	<0.01	<0.01	0.9150		0.0624	
15	0.0105		0.1200	<0.01		0.9200		0.0654	
16	0.0110		0.1218			0.9490			
17	0.0113		0.1227			0.9640			
18	<0.01		0.1250			0.9740			
19						0.9853			
20									
Mean	0.0088	0.0005	0.1084	0.0013	0.0033	0.9134	0.0349	0.0486	0.0031
STDV	0.0016	0.0004	0.0122	0.0007	0.0008	0.0322	0.0028	0.0084	0.0030
Certified	0.0088	0.0005	0.108	0.0013	0.0033	0.91	0.035	0.049	(0.0031)
U _{CRM}	0.0008	0.0004	0.006	0.0006	0.0008	0.02	0.002	0.005	
Methods	I,IM,G,O,X	C	I,IM,G,O,X	I,IM	I,IM	I,G,O,X	I,IM,O,X	I,IM,O,X	I,IM

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