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

Product ID: IARM-NI718-23

Revision No.: 000
Revision Date: 07/14/2023

Product Description: Inconel 718-Type

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	0.484	± 0.009	Cu	0.034	± 0.004	N	0.0070	± 0.0005	Si	0.053	± 0.001
B	0.0039	± 0.0005	Fe	18.10	± 0.08	Nb	5.44	± 0.05	Ta	0.004	± 0.002
C	0.0258	± 0.0008	Mg	0.0012	± 0.0003	Ni	53.4	± 0.3	Ti	1.00	± 0.01
Co	0.293	± 0.009	Mn	0.047	± 0.003	O	0.0009	± 0.0005	V	0.026	± 0.003
Cr	18.08	± 0.09	Mo	2.90	± 0.02	P	0.0073	± 0.0009	W	0.038	± 0.006

Indicative Values listed in ppm

S	5	Sn	6	Zr	40

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.

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

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
- Sheffield Assay Office - Sheffield, England
- 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, 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

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	Mg	Mn	Mo	N	Nb	Ni
1	0.4580	0.0023	0.0236	0.2620	17.80	0.0230	17.75	0.0009	0.0340	2.837	0.0053	5.281	52.40
2	0.4630	0.0029	0.0248	0.2650	17.81	0.0246	17.91	0.0009	0.0360	2.838	0.0060	5.325	52.90
3	0.4710	0.0034	0.0250	0.2760	17.90	0.0300	17.93	0.0010	0.0391	2.848	0.0070	5.382	53.12
4	0.4729	0.0035	0.0250	0.2760	17.91	0.0307	17.97	0.0010	0.0410	2.851	0.0070	5.401	53.16
5	0.4743	0.0035	0.0254	0.2840	17.96	0.0307	18.00	0.0011	0.0440	2.859	0.0070	5.405	53.20
6	0.4750	0.0038	0.0256	0.2870	17.97	0.0329	18.00	0.0011	0.0440	2.870	0.0070	5.405	53.22
7	0.4760	0.0038	0.0258	0.2875	18.00	0.0335	18.00	0.0015	0.0452	2.871	0.0071	5.406	53.30
8	0.4760	0.0039	0.0259	0.2920	18.03	0.0339	18.05	0.0021	0.0460	2.880	0.0073	5.408	53.34
9	0.4770	0.0040	0.0260	0.2928	18.05	0.0346	18.07	<.0005	0.0460	2.894	0.0073	5.409	53.44
10	0.4777	0.0040	0.0263	0.2950	18.05	0.0390	18.08	<0.0005	0.0467	2.900	0.0074	5.414	53.56
11	0.4820	0.0042	0.0270	0.2963	18.10	0.0391	18.13	<0.005	0.0480	2.900	0.0075	5.440	53.60
12	0.4850	0.0043	0.0290	0.2980	18.12	0.0430	18.13	<0.005	0.0482	2.907	0.0086	5.469	53.60
13	0.4870	0.0051		0.2990	18.20	0.0430	18.19	<0.01	0.0488	2.910		5.497	54.33
14	0.4910	0.0060		0.3090	18.26		18.23	<0.01	0.0504	2.919		5.596	54.34
15	0.4914	<0.005		0.3170	18.27		18.29		0.0510	2.928		5.614	
16	0.5040	<0.01		0.3181	18.33		18.30		0.0527	2.930		5.644	
17	0.5193	<0.01		0.3200	18.36		18.30		0.0548	2.940			
18	0.5300				18.36		18.41		0.0569	2.948			
19									0.0613	2.980			
Avg	0.4839	0.0039	0.0258	0.2926	18.08	0.0337	18.10	0.0012	0.0471	2.895	0.0070	5.443	53.39
SD	0.0183	0.0009	0.0013	0.0172	0.18	0.0062	0.17	0.0004	0.0068	0.040	0.0008	0.100	0.51
Certified	0.484	0.0039	0.0258	0.293	18.08	0.034	18.10	0.0012	0.047	2.90	0.0070	5.44	53.4
Uncertainty	0.009	0.0005	0.0008	0.009	0.09	0.004	0.08	0.0003	0.003	0.02	0.0005	0.05	0.3
Methods	I,G,O,X	I,O,IM	C	I,O,IM,X	I,G,O,X	I,G,O,IM,X	I,G,O,X	I,IM	I,G,O,IM,X	I,G,O,X	F	I,G,O,X	I,G,O,X

	O	P	S	Si	Sn	Ta	Ti	V	W	Zr
1	0.0002	0.0043	0.0001	0.0486	0.0005	0.0016	0.9390	0.0186	0.0210	0.0001
2	0.0003	0.0045	0.0003	0.0491	0.0006	0.0027	0.9643	0.0190	0.0223	0.0016
3	0.0005	0.0053	0.0003	0.0500	0.0006	0.0029	0.9810	0.0210	0.0250	0.0016
4	0.0006	0.0060	0.0003	0.0510	0.0007	0.0035	0.9810	0.0213	0.0317	0.0017
5	0.0008	0.0068	0.0006	0.0512	<.0010	0.0038	0.9838	0.0235	0.0330	0.0018
6	0.0012	0.0071	0.0013	0.0513	<0.0001	0.0044	0.9865	0.0240	0.0360	0.0043
7	0.0017	0.0073	<0.0002	0.0519	<0.0006	0.0084	0.9880	0.0243	0.0384	0.0048
8	0.0018	0.0077	<0.0005	0.0520	<0.002	<0.005	0.9900	0.0250	0.0390	0.0064
9	<0.0005	0.0080	<0.001	0.0540	<0.002	<0.005	0.9974	0.0253	0.0392	0.0065
10	<0.0005	0.0080	<0.0010	0.0547	<0.005	<0.005	0.9990	0.0263	0.0401	0.0110
11	<0.001	0.0080	<0.005	0.0550	<0.005	<0.005	1.0030	0.0268	0.0406	<0.005
12	<0.0010	0.0081		0.0554	<0.01	<0.005	1.0040	0.0270	0.0438	
13		0.0086		0.0559	<0.01	<0.01	1.0220	0.0307	0.0479	
14		0.0090		0.0560		<0.01	1.0350	0.0313	0.0520	
15		0.0101					1.0370	0.0330	0.0559	
16		<0.005					1.0424	0.0330		
17		<0.005						0.0340		
18								<0.01		
19										
Avg	0.0009	0.0073	0.0005	0.0526	0.0006	0.0039	0.9971	0.0261	0.0377	0.0040
SD	0.0006	0.0016	0.0004	0.0026	0.0001	0.0022	0.0273	0.0049	0.0101	0.0033
Certified	0.0009	0.0073	(0.0005)	0.053	(0.0006)	0.004	1.00	0.026	0.038	(0.0040)
Uncertainty	0.0005	0.0009		0.001		0.002	0.01	0.003	0.006	
Methods	F	I,G,O,IM,X	C	I,G,IM,X	I,IM,O	I,IM,O	I,G,O,X	I,G,O,IM,X	I,O,IM,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

LGC