

## Certified Reference Material

## Certificate of Analysis

**Product ID:** IARM-NI625-23

ISO  
17034:2016

ISO/IEC  
17025:2017

ISO  
9001:2015

**Product Description:** Nickel Alloy, Nickel Chromium, Inconel,  
Alloy 625 / N06625

Revision No.: 000  
Revision Date: 10/03/2023

**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	0.303	±0.007	B	0.0019	±0.0005	C	0.031	±0.001	Co	0.116	±0.005
Cr	22.27	±0.09	Cu	0.076	±0.003	Fe	3.98	±0.05	Mg	0.0008	±0.0002
Mn	0.080	±0.002	Mo	8.74	±0.04	N	0.010	±0.001	Nb	3.50	±0.05
Ni	60.4	±0.3	P	0.0070	±0.0008	S	0.0004	±0.0002	Si	0.076	±0.006
Ta	0.004	±0.002	Ti	0.296	±0.007	V	0.016	±0.002	W	0.088	±0.003

Indicative Values listed in ppm  
O 6 Sn 7 Zr 6

**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
- Instytut Metalurgii Zelaza - Gliwice, Poland
- Laboratory Testing, Inc. - Hatfield, PA
- LGC Standards - Manchester, NH
- NSL Analytical Services - Cleveland, OH
- 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*

Chuck Goudreau, Certifying Officer

October 03, 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	Hf	Mg	Mn	Mo	N	Nb
1	0.2810	0.0012	0.0279	0.0929	22.01	0.0662	3.773	<0.00005	0.0006	0.0744	8.549	0.0069	3.330
2	0.2896	0.0013	0.0290	0.1068	22.10	0.0675	3.885	<0.0001	0.0006	0.0755	8.680	0.0092	3.407
3	0.2900	0.0013	0.0292	0.1103	22.10	0.0710	3.915	<0.0001	0.0007	0.0762	8.685	0.0098	3.446
4	0.2972	0.0017	0.0300	0.1103	22.13	0.0747	3.950	<0.0010	0.0007	0.0780	8.700	0.0100	3.460
5	0.2990	0.0017	0.0301	0.1115	22.15	0.0750	3.951	<0.005	0.0007	0.0782	8.700	0.0100	3.475
6	0.3000	0.0021	0.0303	0.1124	22.21	0.0750	3.954	<0.005	0.0010	0.0800	8.709	0.0100	3.475
7	0.3020	0.0022	0.0314	0.1147	22.21	0.0760	3.966		0.0013	0.0800	8.710	0.0104	3.505
8	0.3040	0.0023	0.0314	0.1160	22.24	0.0768	3.980		<0.0010	0.0800	8.720	0.0106	3.509
9	0.3040	0.0031	0.0319	0.1180	22.32	0.0770	3.984		<0.005	0.0807	8.756	0.0106	3.510
10	0.3040	<0.005	0.0322	0.1183	22.34	0.0773	4.000		<0.005	0.0810	8.758	0.0113	3.512
11	0.3100	<0.005	0.0322	0.1189	22.34	0.0778	4.015			0.0810	8.765	0.0135	3.524
12	0.3120			0.1190	22.39	0.0793	4.025			0.0813	8.786		3.540
13	0.3130			0.1200	22.48	0.0810	4.028			0.0814	8.830		3.540
14	0.3354			0.1200	22.55	0.0820	4.043			0.0826	8.833		3.621
15				0.1270	22.56	0.0830	4.233			0.0830	8.874		3.707
16				0.1330						0.0858			
Avg	0.3029	0.0019	0.0305	0.1156	22.27	0.0760	3.980		0.0008	0.0799	8.737	0.0102	3.504
SD	0.0129	0.0006	0.0014	0.0089	0.17	0.0048	0.097		0.0003	0.0029	0.079	0.0016	0.086
<b>Certified</b>	<b>0.303</b>	<b>0.0019</b>	<b>0.031</b>	<b>0.116</b>	<b>22.27</b>	<b>0.076</b>	<b>3.98</b>		<b>0.0008</b>	<b>0.080</b>	<b>8.74</b>	<b>0.010</b>	<b>3.50</b>
Uncertainty	0.007	0.0005	0.001	0.005	0.09	0.003	0.05		0.0002	0.002	0.04	0.001	0.05
Methods	I,X,O,IM	I,IM	C	I,X,O,IM	I,X,O,W	I,IM,X	I,X		IM,I	I,IM,X,O	I,X,O	F	I,X

	Ni	O	P	Pb	S	Si	Sn	Ta	Ti	V	W	Zr
1	59.77	0.0004	0.0056	<.0001	0.0002	0.0563	0.0006	0.0014	0.2672	0.0113	0.0758	0.0004
2	59.90	0.0005	0.0057	<.0010	0.0002	0.0695	0.0006	0.0022	0.2800	0.0144	0.0796	0.0005
3	60.32	0.0005	0.0061	<0.00005	0.0003	0.0755	0.0007	0.0033	0.2839	0.0146	0.0805	0.0005
4	60.34	0.0006	0.0062	<0.001	0.0003	0.0770	0.0008	0.0036	0.2840	0.0146	0.0850	<0.0001
5	60.56	0.0009	0.0068	<0.0010	0.0003	0.0786	0.0009	0.0039	0.2880	0.0148	0.0852	<0.0010
6	60.61	<.0005	0.0070	<0.005	0.0005	0.0790	<.0010	0.0043	0.2915	0.0150	0.0876	<0.005
7	60.67	<0.001	0.0070	<0.005	0.0007	0.0796	<0.0010	0.0063	0.2931	0.0160	0.0887	<0.005
8	60.72	<0.0010	0.0070		0.0007	0.0798	<0.005	0.0068	0.2960	0.0180	0.0890	
9			0.0076		<.0005	0.0810	<0.005	<0.005	0.2960	0.0185	0.0900	
10			0.0088		<0.001	0.0886		<0.005	0.2970	0.0190	0.0924	
11			0.0091						0.3018	0.0198	0.0930	
12			<0.0050						0.3020		0.0930	
13			<0.01						0.3030		0.0935	
14									0.3076		0.0954	
15									0.3190			
16									0.3201			
Avg	60.36	0.0006	0.0070		0.0004	0.0765	0.0007	0.0040	0.2956	0.0160	0.0878	0.0006
SD	0.36	0.0002	0.0011		0.0002	0.0085	0.0001	0.0018	0.0137	0.0025	0.0059	0.0003
<b>Certified</b>	<b>60.4</b>	<b>(0.0006)</b>	<b>0.0070</b>		<b>0.0004</b>	<b>0.076</b>	<b>(0.0007)</b>	<b>0.004</b>	<b>0.296</b>	<b>0.016</b>	<b>0.088</b>	<b>(0.0006)</b>
Uncertainty	0.3		0.0008		0.0002	0.006		0.002	0.007	0.002	0.003	
Methods	I,X	F	I,IM,X		C	I,X,IM	IM,I	I,IM	I,X,O,IM	I,IM	I,X,IM	IM,I

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