LGC ARMI

Certificate of Analysis
IARM FeN50-18

Stainless Steel Nitronic 50 / UNS S20910

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	0.006 ± 0.005	**C**	0.030 ± 0.002	**Co**	0.081 ± 0.005	**Cr**	21.0 ± 0.1
Cu	0.28 ± 0.02	**Mn**	5.27 ± 0.08	**Mo**	2.01 ± 0.02	**N**	0.26 ± 0.01
Nb	0.18 ± 0.02	**Ni**	11.90 ± 0.09	**O**	0.006 ± 0.002	**P**	0.026 ± 0.003
S	0.0013 ± 0.0006	**Si**	0.24 ± 0.01	**Sn**	0.007 ± 0.003	**Ti**	0.002 ± 0.002
V	0.121 ± 0.004	**W**	0.023 ± 0.002				

Indicative Values listed in ppm

As (60)	B (7)	Bi (<50)	Ca (14)	Cd (<50)	H (<20)	Mg (<50)
Pb (<50)	Sb (<200)	Se (<50)	Ta (<50)	Zn (<50)	Zr (<50)	

Description and Intended Use

This CRM may come in the form of a solid disk, chips, or powder. The intended use of this CRM may include, but is not limited to, the calibration of instruments and the validation of analytical methods.

Instructions for Use

1. 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.
2. 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.
3. The material should be stored in a cool, dry location when not in use.
4. Chips are not certified for Oxygen analysis.

LGC ARMI ISO 9001:2008

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

	Al	As	B	Bi	C	Ca	Cd	Co	Cr	Cu	Fe	H	Mg	Mn	Mo	N
1	0.00033	0.0051	0.00021	<0.005	0.027	0.0008	<0.005	0.058	20.695	0.198	58.94	0.00029	<0.0001	5.0373	1.9445	0.2474
2	0.0019	0.0055	0.0006		0.0272	0.0014		0.067	20.844	0.26		0.00192	<0.0005	5.14	1.97	0.2497
3	0.00283	0.00583	0.0008		0.0276	0.00163		0.08003	20.86	0.2797			<0.001	5.19	1.9733	0.257
4	0.003	0.0074	0.00133		0.029	0.0017		0.0805	20.97	0.280			<0.005	5.1901	1.9967	0.262
5	0.004	<0.005	<0.0005		0.03	<0.001		0.0818	20.973	0.28				5.191	2.002	0.2643
6	0.004		<0.005		0.0308	<0.005		0.0825	20.98	0.2847				5.206	2.008	0.28
7	0.006				0.0326			0.083	20.98	0.286				5.2167	2.01	
8	0.007				0.0333			0.083	21.003	0.2913				5.227	2.0144	
9	0.012				0.03423			0.084	21.01	0.2922				5.333	2.019	
10	0.0219							0.0848	21.0267	0.2953				5.355	2.024	
11								0.08598	21.041	0.297				5.43	2.025	
12								0.0864	21.125	0.3049				5.44	2.04	
13								0.0922	21.70					5.5231	2.0646	
14																
15																
Mean	0.006	0.006	0.0007		0.030	0.0014		0.081	21.0	0.28				5.27	2.01	0.26
STDV.	0.006	0.001	0.0005		0.003	0.0004		0.009	0.2	0.03				0.10	0.03	0.01
Certified	**0.006**	**(0.006)**	**(0.0007)**	**(<0.005)**	**0.030**	**(0.0014)**	**(<0.005)**	**0.081**	**21.0**	**0.28**	**(58.9)**	**(<0.002)**	**(<0.005)**	**5.27**	**2.01**	**0.26**
U_CRM	0.005				0.002			0.005	0.1	0.02				0.08	0.02	0.01
Methods	I,G,O	I,A	I,O	I	C,G,O	I	I	I,O,X,G	I,O,X,G	I,O,X,G	X	F,I	I	I,O,X,G	I,O,X,G	F,C

	Nb	Ni	O	P	Pb	S	Sb	Se	Si	Sn	Ta	Ti	V	W	Zn	Zr
1	0.1527	11.505	0.004	0.0159	0.000097	0.0004	0.000937	<0.0001	0.2177	0.00363	0.000159	0.0002	0.1049	0.016	0.00012	0.00032
2	0.158	11.771	0.004	0.019	0.0002	0.001	0.0011	<0.001	0.227	0.006	0.00083	0.00026	0.1116	0.02087	0.0003	0.00143
3	0.161	11.852	0.00487	0.025	0.0038	0.00106	0.0018	<0.001	0.232	0.006	0.0241	0.0016	0.119	0.0211	<0.0001	<0.0005
4	0.162	11.87	0.00516	0.0254	<0.001	0.0011	0.0181	<0.005	0.23423	0.00618	0.0347	0.0025	0.12	0.0219	<0.0005	<0.002
5	0.164	11.898	0.0072	0.0255	<0.005	0.00123	<0.005		0.241	0.0068	<0.001	0.0032	0.12	0.023	<0.001	<0.005
6	0.1657	11.907	0.01001	0.0259	<0.005	0.0014	<0.005		0.244	0.011	<0.001	0.005	0.12	0.023	<0.005	
7	0.17	11.9133		0.026		0.0019			0.245	<0.001	<0.002		0.121	0.0238		
8	0.1716	11.9405		0.0266		0.0027			0.248		<0.005		0.12253	0.025		
9	0.179	11.9467		0.0271		<0.001			0.2534				0.123	0.0256		
10	0.185	11.98		0.0281					0.259				0.126	0.026		
11	0.2315	12.00		0.02963					0.2605				0.1267	0.02983		
12	0.2521	12.0467		0.0305					0.27				0.1305			
13		12.08		0.031					0.290				0.132			
14																
15																
Mean	0.18	11.9	0.006	0.026	0.001	0.0013	0.010		0.24	0.007		0.002	0.121	0.023		
STDV.	0.03	0.10	0.002	0.004	0.001	0.0007	0.008		0.02	0.002		0.002	0.007	0.004		
Certified	**0.18**	**11.90**	**0.006**	**0.026**	**(<0.005)**	**0.0013**	**(<0.02)**	**(<0.005)**	**0.24**	**0.007**	**(<0.005)**	**0.002**	**0.121**	**0.023**	**(<0.005)**	**(<0.005)**
U_CRM	0.02	0.09	0.002	0.003		0.0006			0.01	0.003		0.002	0.004	0.002		
Methods	I,O,X,G	I,O,X,G	F,C	I,O,X,G	I,A,O	C,G,O	I,A	A,I	I,O,X,G	I,A,O	I,G	I,O	I,O,X,G	I,X,G,O	I	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

Certification Laboratories

Connecticut Metallurgical Inc.	East Hartford, CT	Dirats Laboratories	Westfield, MA
Massachusetts Materials Research, Inc.	West Boylston, MA	IMR Test Labs	Lansing, NY
EAG Laboratories	Liverpool, NY	Luvak	Boylston, MA
New Hampshire Materials Lab	Somersworth, NH	VHG Labs	Manchester, NH

Certification laboratories have demonstrated performance and traceability by utilizing test methods under the scope of ISO 17025 or have shown competence through a proficiency testing program. Some of the specific CRMs and SRMs used in the analysis of the material covered by this certificate are:

NIST 160B   NIST 363   IARM 175B   IARM 17C   IARM 1B   IARM 5B   IARM 62C   IARM 6D   IARM 8C

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.

$$1. \quad N_{min} = \max(10, \sqrt[3]{N_{prod}})$$

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

Expiration

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.

David Coler, General Manager

Analytical Reference Materials International