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Certified Reference Material

Certificate of Analysis

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

Product ID: IARM-Fe309-18

Product Description: AISI 309 / UNS S30900

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

As	0.0065	± 0.0007	C	0.066	± 0.002	Co	0.248	± 0.008	Cr	22.42	± 0.07
Cu	0.430	± 0.008	Mn	1.61	± 0.02	Mo	0.357	± 0.005	Nb	0.021	± 0.002
Ni	12.2	± 0.1	P	0.029	± 0.001	Sb	0.0018	± 0.0002	Si	0.30	± 0.01
Sn	0.012	± 0.001	V	0.073	± 0.003	W	0.063	± 0.004			

Indicative Values listed in ppm

Al	(100)	B	(<10)	Fe	(62%)	Mg	(<10)	N	(580)	O	(29)	S	(20)
Ti	(30)	Zr	(20)										

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.

- LGC Standards - Manchester, NH
- Dirats Laboratories - Westfield, MA
- NSL Analytical Services - Cleveland, OH
- Laboratory Testing, Inc. - Hatfield, PA
- Element Material Technology - Middlesbrough, UK
- AnchorCert Analytical - Birmingham, UK

- Connecticut Metallurgical, Inc. - East Hartford, CT
- IMR Test Labs - Lansing, NY
- SGS MSi - Melrose Park, IL
- Scrooby's Laboratory Service - Rynfield, South Africa
- Universal Scientific Laboratory - Revesby, Australia

- Sheffield Assay Office - Sheffield, UK
- EAG Laboratories - Liverpool, NY
- TCR Engineering Services - Maharashtra, India
- Luvak Inc. - Boylston, MA
- 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.

Kimberly Halkiotis, Global Product Manager

<u>September 29, 2021</u>
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	As	B	C	Co	Cr	Cu	Fe	Mg	Mn	Mo	N	Nb	Ni
1	0.0009	0.0032	0.0001	0.0600	0.2280	22.1100	0.3910	60.790	0.0002	1.5150	0.3380	0.0449	0.0130	11.8200
2	0.0011	0.0057	0.0006	0.0627	0.2323	22.2000	0.4053	61.010	0.0010	1.5430	0.3400	0.0600	0.0140	11.8700
3	0.0016	0.0060	<0.001	0.0632	0.2330	22.2300	0.4080	61.690		1.5630	0.3460	0.0610	0.0153	11.9020
4	0.0020	0.0062		0.0640	0.2336	22.3300	0.4138	61.740		1.5900	0.3500	0.0610	0.0178	11.9200
5	0.0020	0.0062		0.0640	0.2350	22.3333	0.4170	62.110		1.5932	0.3510	0.0614	0.0179	11.9700
6	0.0037	0.0065		0.0644	0.2400	22.3760	0.4170	62.347		1.6080	0.3510	0.0624	0.0190	12.0000
7	0.0052	0.0066		0.0650	0.2410	22.3800	0.4182	62.500		1.6080	0.3540		0.0190	12.0500
8	0.0060	0.0069		0.0650	0.2420	22.3900	0.4228	62.500		1.6086	0.3540		0.0190	12.0600
9	0.0065	0.0070		0.0658	0.2440	22.4335	0.4243	62.560		1.6100	0.3549		0.0200	12.0667
10	0.0070	0.0070		0.0669	0.2452	22.4550	0.4277	62.580		1.6100	0.3580		0.0201	12.1067
11	0.0090	0.0073		0.0673	0.2458	22.4600	0.4290			1.6100	0.3600		0.0209	12.1100
12	0.0100	0.0075		0.0674	0.2480	22.4700	0.4300			1.6150	0.3620		0.0210	12.1100
13	0.0100	0.0081		0.0680	0.2500	22.4800	0.4303			1.6180	0.3621		0.0213	12.1462
14	0.0110	<0.005		0.0688	0.2510	22.4800	0.4320			1.6190	0.3627		0.0214	12.1700
15	0.0110	<0.005		0.0691	0.2510	22.4855	0.4400			1.6220	0.3630		0.0231	12.2110
16	0.0110			0.0700	0.2530	22.5200	0.4400			1.6270	0.3639		0.0241	12.3800
17	0.0122			0.0732	0.2610	22.5697	0.4500			1.6290	0.3650		0.0256	12.4430
18	0.0160				0.2830	22.5800	0.4500			1.6320	0.3683		0.0260	12.4500
19	<0.002				0.2920	22.6900	0.4520			1.6440	0.3740		0.0290	12.5400
20	<0.005						0.4600			1.6920			0.0310	12.6200
21	<0.01						0.4620			1.7003				12.8883
Mean	0.0070	0.0065	0.0004	0.0662	0.2478	22.420	0.4295	61.983	0.0006	1.6122	0.3567	0.0585	0.0209	12.183
STDV	0.0045	0.0012	0.0003	0.0032	0.0163	0.1392	0.0185	0.6572	0.0005	0.0411	0.0093	0.0067	0.0046	0.2753
Certified	(0.010)	0.0065	(<0.001)	0.066	0.248	22.42	0.43	(62.0)	(<0.001)	1.61	0.357	(0.058)	0.021	12.2
U_{CRM}		0.0007		0.002	0.008	0.07	0.008			0.02	0.005		0.002	0.1
Methods	I,IM,O,X	IM,O,I,X	IM,O	C,O	I,IM,O	I,O,W,X	I,O,X	O,I,X,W	IM,O	I,O,X	I,O,X	F,C	I,IM,O,X	I,O,X,W

	O	P	S	Sb	Si	Sn	Ti	V	W	Zr				
1	0.0023	0.0227	0.0004	0.0012	0.2420	0.0060	0.0006	0.0580	0.0528	0.0008				
2	0.0029	0.0233	0.0006	0.0016	0.2580	0.0086	0.0007	0.0620	0.0530	0.0017				
3	0.0030	0.0240	0.0006	0.0017	0.2600	0.0090	0.0011	0.0695	0.0540	0.0020				
4	0.0035	0.0270	0.0006	0.0017	0.2810	0.0100	0.0020	0.0703	0.0540	0.0025				
5		0.0283	0.0007	0.0017	0.2820	0.0100	0.0020	0.0704	0.0560	<0.00005				
6		0.0285	0.0008	0.0017	0.2883	0.0110	0.0021	0.0710	0.0593	<0.0001				
7		0.0288	0.0008	0.0018	0.2890	0.0112	0.0025	0.0715	0.0600	<0.0005				
8		0.0295	0.0008	0.0018	0.2907	0.0113	0.0027	0.0738	0.0601	<0.001				
9		0.0296	0.0010	0.0020	0.2910	0.0116	0.0039	0.0747	0.0615	<0.001				
10		0.0299	0.0023	0.0020	0.2944	0.0117	0.0070	0.0750	0.0626	<0.002				
11		0.0300	0.0030	0.0020	0.2990	0.0118	0.0080	0.0760	0.0630	<0.005				
12		0.0300	0.0030	0.0020	0.3010	0.0119	0.0090	0.0760	0.0650	<0.005				
13		0.0304	0.0030	<0.002	0.3020	0.0120	<0.0005	0.0768	0.0660	<0.01				
14		0.0310	0.0036		0.3020	0.0127	<0.001	0.0770	0.0668	<0.01				
15		0.0310	0.0045		0.3150	0.0130	<0.001	0.0780	0.0669					
16		0.0310	0.0050		0.3243	0.0150	<0.002	0.0780	0.0692					
17		0.0310	<0.001		0.3300	0.0150	<0.005	0.0781	0.0710					
18		0.0313	<0.001		0.3410	0.0190	<0.005	0.0790	0.0710					
19		0.0330	<0.003		0.3411		<0.005	0.0800	0.0716					
20		0.0335	<0.003				<0.01		0.0790					
21			<0.005											
Mean	0.0029	0.0292	0.0019	0.0018	0.2964	0.0117	0.0035	0.0734	0.0631	0.0017				
STDV	0.0005	0.0029	0.0016	0.0002	0.0266	0.0028	0.0029	0.0057	0.0072	0.0007				
Certified	(0.0029)	0.029	(0.002)	0.0018	0.30	0.012	(0.003)	0.073	0.063	(0.002)				
U_{CRM}		0.001		0.0002	0.01	0.001		0.003	0.004					
Methods	F,C	I,IM,O,X,W	C,O,X	IM,O,I	I,IM,O,X,W	I,IM,O	I,IM,O,X	I,IM,O	I,IM,O,X	I,IM,O				

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

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