

Certified Reference Material

Certificate of Analysis

Product ID: IARM-FED6AC-22

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Alloy Steel, Welding Wire, D6-AC / K24728

Revision No.: 000
Revision Date: 11/14/2022

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	0.035	± 0.001	Cr	1.02	± 0.01	Nb	0.0037	± 0.0005	Sn	0.0019	± 0.0004
As	0.0031	± 0.0004	Cu	0.036	± 0.001	Ni	0.539	± 0.008	Ti	0.0021	± 0.0002
B	0.00023	± 0.00007	Mn	0.82	± 0.01	O	0.0010	± 0.0007	V	0.108	± 0.002
C	0.471	± 0.009	Mo	0.98	± 0.02	P	0.0068	± 0.0006	W	0.0026	± 0.0009
Co	0.0050	± 0.0005	N	0.0038	± 0.0008	Si	0.260	± 0.005			

Indicative Values listed in ppm

Pb (20) S (19)

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-recognized 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.

- AnchorCert Analytical - Birmingham, England
- Applied Technical Services - Marietta, GA
- Cleveland Cliffs - West Chester, OH
- Connecticut Metallurgical, Inc. - East Hartford, CT
- Dirts Laboratories - Westfield, MA
- Eurofins EAG Laboratories - Liverpool, NY
- IMR Test Labs - Louisville, KY
- LGC Standards - Manchester, NH
- Lithea S.R.O. - Brno, Czech Republic
- Luvak Inc - Boylston, MA
- 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
- TCR Engineering - Navi Mumbai, India

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

14 November 2022
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	Mn	Mo	N	Nb
1	0.0290	0.0020	0.00009	0.4410	0.0030	0.9560	0.0308	0.7730	0.9080	0.0020	0.0020
2	0.0315	0.0023	0.00020	0.4490	0.0032	0.9640	0.0320	0.7810	0.9200	0.0028	0.0020
3	0.0320	0.0023	0.00020	0.4580	0.0035	0.9870	0.0340	0.7860	0.9280	0.0032	0.0020
4	0.0330	0.0026	0.00020	0.4640	0.0042	1.0000	0.0341	0.7950	0.9400	0.0041	0.0024
5	0.0330	0.0028	0.00026	0.4670	0.0045	1.0000	0.0345	0.8000	0.9470	0.0043	0.0025
6	0.0330	0.0028	0.00030	0.4700	0.0046	1.0020	0.0349	0.8040	0.9500	0.0044	0.0029
7	0.0332	0.0030	0.00033	0.4700	0.0050	1.0086	0.0350	0.8160	0.9644	0.0045	0.0030
8	0.0340	0.0030	<0.0005	0.4710	0.0051	1.0100	0.0350	0.8160	0.9672	0.0048	0.0036
9	0.0340	0.0030	<0.0005	0.4710	0.0051	1.0120	0.0351	0.8200	0.9770		0.0040
10	0.0346	0.0031	<0.0005	0.4730	0.0052	1.0140	0.0354	0.8217	0.9808		0.0040
11	0.0348	0.0034	<0.001	0.4740	0.0055	1.0160	0.0358	0.8270	0.9812		0.0040
12	0.0350	0.0035	<0.001	0.4770	0.0055	1.0200	0.0360	0.8270	0.9930		0.0040
13	0.0350	0.0038	<0.001	0.4810	0.0056	1.0203	0.0360	0.8320	0.9950		0.0041
14	0.0350	0.0039	<0.0010	0.4950	0.0056	1.0240	0.0360	0.8350	0.9950		0.0042
15	0.0353	0.0040	<0.002	0.5040	0.0057	1.0240	0.0361	0.8370	0.9960		0.0046
16	0.0358	0.0046			0.0057	1.0268	0.0363	0.8389	0.9960		0.0046
17	0.0361	<0.0001			0.0060	1.0340	0.0370	0.8390	0.9980		0.0047
18	0.0364	<0.003			0.0060	1.0360	0.0390	0.8400	1.0000		0.0051
19	0.0367	<0.0050			0.0063	1.0540	0.0390	0.8400	1.0010		0.0053
20	0.0375	<0.01			<0.01	1.0600	0.0395	0.8410	1.0090		0.0056
21	0.0410	<0.01			<0.01	1.0700	0.0400	0.8424	1.0150		<0.001
22	0.0419					1.0700	0.0410	0.8430	1.0200		<0.01
23							0.0431	0.8513	1.0400		
24									1.0450		
Mean	0.0349	0.0031	0.00023	0.4710	0.0050	1.0186	0.0363	0.8220	0.9819	0.0038	0.0037
STDV	0.0029	0.0007	0.00008	0.0157	0.0010	0.0293	0.0028	0.0222	0.0356	0.0010	0.0011
Certified	0.035	0.0031	0.00023	0.471	0.0050	1.02	0.036	0.82	0.98	0.0038	0.0037
U _{CRM}	0.001	0.0004	0.00007	0.009	0.0005	0.01	0.001	0.01	0.02	0.0008	0.0005
Methods	I,G,IM,O,X	I,G,IM,O,A,X	I,G,IM,O	C,I,G,O	I,G,IM,O,X	I,G,O,X	I,IM,O,X	I,G,O,X	I,G,O,X	C,F,I,O	I,G,IM,O,X

	Ni	O	P	Pb	S	Si	Sn	Ti	V	W
1	0.5000	0.00030	0.0043	0.0008	0.0007	0.2390	0.0010	0.0013	0.1000	0.0008
2	0.5020	0.00052	0.0052	0.0009	0.0009	0.2460	0.0010	0.0017	0.1000	0.0010
3	0.5050	0.00080	0.0057	0.0010	0.0010	0.2500	0.0011	0.0017	0.1020	0.0011
4	0.5160	0.00086	0.0059	0.0011	0.0015	0.2500	0.0012	0.0018	0.1031	0.0020
5	0.5219	0.00160	0.0061	0.0012	0.0017	0.2509	0.0012	0.0019	0.1040	0.0022
6	0.5228	0.00200	0.0061	0.0030	0.0018	0.2530	0.0013	0.0019	0.1050	0.0023
7	0.5300		0.0062	0.0030	0.0020	0.2530	0.0013	0.0020	0.1060	0.0030
8	0.5350		0.0062	0.0050	0.0022	0.2542	0.0015	0.0020	0.1064	0.0040
9	0.5380		0.0066	<0.00005	0.0026	0.2570	0.0016	0.0020	0.1069	0.0040
10	0.5400		0.0068	<0.0002	0.0030	0.2590	0.0020	0.0020	0.1074	0.0041
11	0.5400		0.0068	<0.0009	0.0030	0.2600	0.0020	0.0020	0.1084	0.0047
12	0.5400		0.0069	<0.0010	<0.0005	0.2600	0.0020	0.0020	0.1100	<0.003
13	0.5410		0.0070	<0.0011	<0.001	0.2630	0.0025	0.0020	0.1100	<0.01
14	0.5470		0.0070	<0.002	<0.0010	0.2640	0.0027	0.0020	0.1100	<0.01
15	0.5489		0.0071	<0.002	<0.002	0.2670	0.0028	0.0020	0.1100	
16	0.5490		0.0080	<0.002		0.2700	0.0030	0.0022	0.1100	
17	0.5500		0.0080	<0.01		0.2760	0.0030	0.0023	0.1110	
18	0.5509		0.0090	<0.01		0.2789	0.0030	0.0024	0.1111	
19	0.5510		0.0096			0.2800	<0.001	0.0025	0.1120	
20	0.5550		<0.0050				<0.002	0.0026	0.1120	
21	0.5630						<0.01	0.0029	0.1130	
22	0.5670						<0.01	<0.002		
23	0.5670									
24	0.5670									
Mean	0.5395	0.00101	0.0068	0.0020	0.0019	0.2595	0.0019	0.0021	0.1075	0.0026
STDV	0.0199	0.00065	0.0013	0.0015	0.0008	0.0112	0.0008	0.0003	0.0040	0.0014
Certified	0.539	0.0010	0.0068	(0.002)	(0.0019)	0.260	0.0019	0.0021	0.108	0.0026
U _{CRM}	0.008	0.0007	0.0006			0.005	0.0004	0.0002	0.002	0.0009
Methods	I,G,O,X	C,F,I	I,G,IM,O,X	I,G,IM,O,A,X	C,I,G,O,X	I,IM,O,X	I,G,IM,O,A,X	I,G,IM,O,X	I,IM,O,X	I,G,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