

Certified Reference Material

Certificate of Analysis

Product ID: MBH-13X 12548 N

ISO
17034:2016

ISO/IEC
17025:2017

ISO
9001:2015

Product Description: Stainless Steel, Martensitic (Cr) Steel

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 0.003 ± 0.001	C 0.175 ± 0.005	Co 0.388 ± 0.004	Cr 12.70 ± 0.09
Cu 0.264 ± 0.006	Mn 0.510 ± 0.008	Mo 1.42 ± 0.02	N 0.102 ± 0.005
Nb 0.49 ± 0.01	Ni 1.10 ± 0.01	P 0.023 ± 0.001	Pb 0.002 ± 0.001
S 0.189 ± 0.009	Sb 0.019 ± 0.003	Si 0.193 ± 0.005	Sn 0.0064 ± 0.0004
Ti 0.0015 ± 0.003	V 0.025 ± 0.002	W 0.038 ± 0.002	

Indicative Values listed in ppm

Al (200)	B (<10)	Fe (<83%)	Zr (20)
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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.

$$1. N_{MIN} = \max(10, \sqrt[3]{N_{PROD}})$$

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

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.

- LGC Standards - Manchester, NH
- Connecticut Metallurgical, Inc. - East Hartford, CT
- NSL Analytical Services - Cleveland, OH
- SGS MSI - Melrose Park, IL
- IMR Test Labs - Lansing, NY
- Cleveland Cliffs - Middletown, OH
- Applied Technical Services - Marietta, GA
- EAG Laboratories - Liverpool, NY
- Sheffield Assay Office - Sheffield, UK
- Scrooby's Laboratory Service - Rynfield, South Africa
- Element Materials Technology - Middlesbrough, UK
- New Hampshire Materials Laboratory - Somersworth, NH
- RSML - Bengaluru, India

Instructions for Use: The test surface is on the opposite side of the labeled surface, which includes the material identification. This material is individually chill cast per piece. This manner of casting can cause the formation of inhomogeneous segregates in the upper, engraved portion of the disk. Therefore, the certification information above is not applicable to within 3mm of the engraved surface. 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 Halkotis, Global Product Manager

February 7, 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	Fe	Mn	Mo	N	Nb	Ni
1	0.0180	0.0016	0.0007	0.1620	0.3726	12.360	0.2431	82.490	0.4760	1.3440	0.0970	0.4490	1.0553
2	0.0024	0.0016	0.0010	0.1650	0.3750	12.410	0.2480	83.410	0.4940	1.3590	0.0980	0.4590	1.0640
3	0.0058	0.0018	0.0015	0.1660	0.3840	12.450	0.2490		0.4950	1.3600	0.0995	0.4640	1.0820
4	0.0060	0.0027		0.1700	0.3860	12.530	0.2516		0.4950	1.3996	0.1000	0.4696	1.0870
5	0.0070	0.0030		0.1700	0.3861	12.530	0.2540		0.4960	1.4060	0.1010	0.4760	1.0870
6	0.0083	0.0033		0.1710	0.3870	12.594	0.2550		0.4990	1.4090	0.1070	0.4770	1.0920
7	0.0086	0.0061		0.1720	0.3890	12.624	0.2563		0.5036	1.4130	0.1110	0.4870	1.0943
8	0.0110	<0.002		0.1720	0.3905	12.721	0.2590		0.5090	1.4190		0.4876	1.0960
9	0.0110	<0.002		0.1732	0.3910	12.726	0.2590		0.5110	1.4220		0.4890	1.0980
10	0.0144	<0.005		0.1780	0.3920	12.747	0.2623		0.5120	1.4290		0.4900	1.1020
11	0.0190	<0.0050		0.1780	0.3930	12.765	0.2628		0.5160	1.4344		0.4948	1.1050
12	0.0192			0.1790	0.3960	12.767	0.2640		0.5160	1.4360		0.4950	1.1054
13	0.0200			0.1826	0.3960	12.780	0.2690		0.5180	1.4370		0.5106	1.1062
14	0.0220			0.1860	0.3980	12.788	0.2700		0.5228	1.4410		0.5120	1.1120
15	0.0220			0.1930		12.790	0.2740		0.5240	1.4530		0.5170	1.1150
16	0.0221					12.850	0.2750		0.5250	1.4670		0.5250	1.1210
17	0.0280					12.878	0.2770		0.5320	1.4760			1.1270
18	0.0291					12.892	0.2790		0.5370				1.1420
19	0.0390					13.060	0.2890						1.1510
20	<0.01						0.2900						
Mean	0.0165	0.0029	0.0011	0.1745	0.3883	12.698	0.2644	82.950	0.5101	1.4179	0.1019	0.4877	1.1022
STDV	0.0095	0.0016	0.0004	0.0083	0.0074	0.1813	0.0133	0.6505	0.0156	0.0367	0.0051	0.0215	0.0235
Certified	(0.02)	0.003	(<0.001)	0.175	0.388	12.70	0.264	(<83)	0.510	1.42	0.102	0.49	1.10
U _{CRM}		0.001		0.005	0.004	0.09	0.006		0.008	0.02	0.005	0.01	0.01
Methods	I,O,G,IM,X	IM,I,X,O	IM,I,O	C,G,O	I,O,IM,X	I,O,X	I,O,G,IM,X	O	I,O,G,X	I,O,G,X	F	I,O,X	I,O,G,X

	P	Pb	S	Sb	Si	Sn	Ti	V	W	Zr
1	0.0208	0.0006	0.1650	0.0120	0.1690	0.0060	0.0011	0.0219	0.0313	0.0020
2	0.0209	0.0009	0.1690	0.0152	0.1790	0.0046	0.0013	0.0225	0.0340	0.0013
3	0.0212	0.0011	0.1700	0.0173	0.1810	0.0060	0.0014	0.0230	0.0341	0.0018
4	0.0220	0.0020	0.1750	0.0191	0.1850	0.0060	0.0014	0.0230	0.0357	0.0036
5	0.0220	0.0022	0.1770	0.0192	0.1850	0.0060	0.0015	0.0230	0.0385	<0.00005
6	0.0221	0.0035	0.1786	0.0200	0.1860	0.0060	0.0017	0.0230	0.0385	<0.0005
7	0.0228	0.0037	0.1812	0.0234	0.1870	0.0060	0.0020	0.0240	0.0389	<0.0010
8	0.0231	<0.0010	0.1850	0.0240	0.1901	0.0061	<0.0005	0.0247	0.0390	<0.002
9	0.0233	<0.002	0.1930	<0.0020	0.1910	0.0062	<0.001	0.0253	0.0399	<0.005
10	0.0239	<0.002	0.1960		0.1970	0.0065	<0.001	0.0260	0.0400	<0.01
11	0.0240	<0.002	0.1974		0.1990	0.0066	<0.001	0.0260	0.0400	
12	0.0240	<0.005	0.1985		0.1991	0.0069	<0.001	0.0268	0.0400	
13	0.0260		0.2060		0.2000	0.0071	<0.0010	0.0270	0.0400	
14	0.0270		0.2060		0.2000	0.0074	<0.002	0.0271	0.0406	
15	0.0270		0.2110		0.2000	0.0076	<0.002	0.0303	0.0410	
16			0.2130		0.2010	0.0080	<0.002	0.0320	0.0430	
17					0.2020	<0.01	<0.005			
18					0.2052		<0.005			
19					0.2070		<0.01			
20										
Mean	0.0233	0.0020	0.1889	0.0188	0.1928	0.0064	0.0015	0.0254	0.0384	0.0022
STDV	0.0020	0.0012	0.0158	0.0040	0.0102	0.0008	0.0003	0.0028	0.0031	0.0010
Certified	0.023	0.002	0.189	0.019	0.193	0.0064	0.0015	0.025	0.038	(0.002)
U _{CRM}	0.001	0.001	0.009	0.003	0.005	0.0004	0.0003	0.002	0.002	
Methods	I,O,G,IM,X	IM,I,O,X	C,G,O,X,I	IM,X,O,I	I,O,G,IM,X	I,O,IM,X	I,O,G,IM,X	I,O,G,IM,X	O,I,IM,X	I,O,IM,X

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

