

Certified Reference Material **Certificate of Analysis**

Product ID: MBH-13X NSC1 Q

ISO 17034:2016	ISO/IEC 17025:2017	ISO 9001:2015
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Product Description: High Nitrogen Stainless Steel

Revision No.: 001
Revision Date: 02/11/2022

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	0.034	± 0.003	C	0.269	± 0.008	Co	0.015	± 0.002	Cr	19.46	± 0.07
Cu	0.438	± 0.006	Mn	6.79	± 0.05	Mo	0.240	± 0.006	N	0.087	± 0.003
Nb	1.48	± 0.03	Ni	5.10	± 0.04	P	0.0103	± 0.0009	S	0.007	± 0.002
Si	0.93	± 0.02	Sn	0.0026	± 0.0006	Ti	0.004	± 0.001	V	0.540	± 0.009
W	0.104	± 0.002									

Indicative Values listed in ppm						
As (30)	B (<4)	Fe (<64%)	Mg (<100)	Pb (20)	Sb (200)	Se (50)
Ta (<100)	Zn (100)	Zr (30)				

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.

$$1. N_{MIN} = \max(10, \sqrt[3]{N_{PROD}}) \qquad 2. U_{CRM} = \frac{\sqrt{H^2 + S^2}}{\sqrt{n}} * t$$

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
- Connecticut Metallurgical, Inc. - East Hartford, CT
- IMR Test Labs - Lansing, NY
- NSL Analytical Services - Cleveland, OH
- SGS MSI - Melrose Park, IL
- 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 11, 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	Mg	Mn	Mo	N	Nb	Ni
1	0.0240	0.0010	0.0004	0.2410	0.0110	19.2400	0.4100	63.7200	0.0010	6.6690	0.2120	0.0810	1.3550	4.9430
2	0.0252	0.0014	0.0004	0.2530	0.0118	19.2400	0.4200	64.6600	0.0019	6.6780	0.2230	0.0850	1.4200	4.9970
3	0.0270	0.0016	0.0005	0.2560	0.0120	19.2600	0.4220		0.0330	6.7020	0.2230	0.0860	1.4220	5.0150
4	0.0275	0.0021		0.2630	0.0122	19.3150	0.4245		<0.0005	6.7030	0.2280	0.0866	1.4443	5.0490
5	0.0300	0.0022		0.2649	0.0134	19.3600	0.4280		<0.0005	6.7170	0.2346	0.0880	1.4460	5.0510
6	0.0305	0.0050		0.2673	0.0140	19.3810	0.4320		<0.001	6.7240	0.2350	0.0880	1.4600	5.0556
7	0.0320	0.0065		0.2680	0.0140	19.3900	0.4370		<0.0010	6.7600	0.2353	0.0880	1.4670	5.0650
8	0.0360	0.0079		0.2690	0.0140	19.3930	0.4380		<0.0010	6.7956	0.2360	0.0918	1.4690	5.0730
9	0.0370	<0.0005		0.2700	0.0150	19.4430	0.4381		<0.005	6.8021	0.2410		1.4700	5.0750
10	0.0370	<0.002		0.2730	0.0153	19.5000	0.4390		<0.01	6.8183	0.2470		1.4770	5.1120
11	0.0381	<0.002		0.2780	0.0155	19.5380	0.4400			6.8250	0.2470		1.4880	5.1160
12	0.0384	<0.005		0.2840	0.0170	19.5400	0.4420			6.8380	0.2470		1.4940	5.1240
13	0.0386	<0.0050		0.2900	0.0180	19.5600	0.4440			6.8400	0.2471		1.4970	5.1300
14	0.0390			0.2950	0.0200	19.5700	0.4450			6.8440	0.2490		1.5059	5.1500
15	0.0396				0.0242	19.6340	0.4450			6.8700	0.2514		1.5555	5.1560
16	0.0410					19.6500	0.4500			6.9400	0.2520		1.5620	5.1580
17	0.0420					19.6500	0.4540			6.9610	0.2520		1.5890	5.1770
18						19.6610	0.4580				0.2550		1.5930	5.2300
19							0.4610							5.2650
Mean	0.0343	0.0035	0.0004	0.2694	0.0152	19.4625	0.4383	64.1900	0.0120	6.7934	0.2397	0.0868	1.4842	5.1022
STDV	0.0059	0.0026	0.0000	0.0144	0.0035	0.1461	0.0133	0.6647	0.0182	0.0869	0.0122	0.0031	0.0613	0.0792
Certified	0.034	(0.003)	(<0.0004)	0.269	0.015	19.46	0.438	(<64)	(<0.01)	6.79	0.24	0.087	1.48	5.1
U _{CRM}	0.003			0.008	0.002	0.07	0.006			0.05	0.006	0.003	0.03	0.04
Methods	I,O,G,IM,X	O,I,IM,X	IM,I,O	C,G,O	I,O,IM,X	I,O,G,X	I,O,G,IM,X	O,I	I,O,IM	O,I,G,X	I,O,IM,X	F	I,O,G,X	I,O,X

	P	Pb	S	Sb	Se	Si	Sn	Ta	Ti	V	W	Zn	Zr
1	0.0070	0.0005	0.0059	0.0004	0.0004	0.8660	0.0019	0.0059	0.0060	0.5040	0.0970	0.0080	0.0032
2	0.0080	0.0006	0.0060	0.0004	0.0057	0.8890	0.0019	0.0082	0.0010	0.5100	0.0976	0.0043	0.0001
3	0.0089	0.0010	0.0063	0.0018	0.0065	0.8930	0.0020		0.0012	0.5216	0.0979	0.0054	0.0015
4	0.0090	0.0021	0.0071	0.0024	0.0069	0.8932	0.0020		0.0017	0.5226	0.0980	0.0059	0.0028
5	0.0090	0.0048	0.0072	0.0070	<0.0005	0.9030	0.0027		0.0028	0.5230	0.0995	0.0100	0.0029
6	0.0091	<0.0010	0.0074	<0.0005	<0.002	0.9040	0.0030		0.0033	0.5242	0.1000	0.0195	0.0065
7	0.0100	<0.0010	0.0076	<0.0010	<0.0050	0.9110	0.0030		0.0039	0.5380	0.1020	0.0200	<0.0005
8	0.0101	<0.002	0.0080	<0.002		0.9130	0.0032		0.0050	0.5380	0.1038	0.0300	<0.0010
9	0.0102	<0.002	0.0080	<0.0020		0.9265	0.0040		0.0050	0.5389	0.1050	<0.001	<0.002
10	0.0110	<0.002	0.0080			0.9270	<0.001		0.0050	0.5460	0.1060	<0.0010	<0.005
11	0.0110		0.0085			0.9340	<0.002		0.0059	0.5476	0.1060	<0.01	<0.005
12	0.0110					0.9384	<0.002		<0.0005	0.5550	0.1065		<0.01
13	0.0119					0.9420	<0.002		<0.001	0.5560	0.1070		
14	0.0120					0.9470	<0.0020		<0.005	0.5560	0.1076		
15	0.0130					0.9530	<0.005		<0.005	0.5570	0.1080		
16	0.0134					0.9800	<0.01		<0.01	0.5580	0.1081		
17						0.9800				0.5590	0.1100		
18						0.9950				0.5710			
19													
Mean	0.0103	0.0018	0.0073	0.0164	0.0049	0.9275	0.0026	0.0071	0.0037	0.5403	0.1035	0.0129	0.0028
STDV	0.0018	0.0018	0.0009	0.0339	0.0030	0.0349	0.0007	0.0016	0.0018	0.0190	0.0044	0.0092	0.0021
Certified	0.0103	(0.002)	0.007	(0.02)	(0.005)	0.93	0.0026	(<0.01)	0.004	0.54	0.104	(0.01)	(0.003)
U _{CRM}	0.0009		0.002			0.02	0.0006		0.001	0.009	0.002		
Methods	I,O,IM,X	IM,I,O,X	C,G	IM,X,O	IM,X,O	I,O,G,X	I,O,IM,X	IM,I	I,O,G,IM,X	I,O,G,X	I,O,G,IM,X	I,O,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

