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ANALYTICAL LTD

ISO Certified · 9001 · 17025 · 17043 · 17034

Certificate of Analysis

MBH 13X NSC2 Q

High-Nitrogen Stainless Steel

Certified Reference Material

Certified Values listed in wt.% with associated uncertainties

Al	**0.37** ± 0.02	**C**	**0.574** ± 0.006	**Cr**	**20.95** ± 0.09	**Cu**	**1.01** ± 0.02
Mn	**8.02** ± 0.05	**Mo**	**0.339** ± 0.006	**N**	**0.299** ± 0.005	**Nb**	**2.03** ± 0.04
Ni	**3.63** ± 0.03	**S**	**0.014** ± 0.001	**Si**	**1.02** ± 0.03	**V**	**0.293** ± 0.009
W	**0.063** ± 0.004						

Description and Intended Use

This Certified Reference Material has been produced and certified, wherever possible, in accordance with the requirements of ISO 17034 and the associated Guides, taking into account the requirements of the ISO Guide to the Expression of Uncertainty in Measurement (GUM). 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.

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 recommended for gas analysis.

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

	Al	C	Cr	Cu	Mn	Mo	N	Nb	Ni	S	Si	V	W			
1	0.4260	0.5880	21.170	1.082	8.140	0.3555	0.3117	2.148	3.728	0.0161	1.098	0.3233	0.0717			
2	0.4074	0.5836	21.144	1.061	8.120	0.3527	0.3050	2.108	3.693	0.0155	1.066	0.3230	0.0705			
3	0.4060	0.5823	21.092	1.054	8.105	0.3482	0.3044	2.093	3.690	0.0154	1.055	0.3150	0.0675			
4	0.3910	0.5820	21.080	1.036	8.105	0.3455	0.3030	2.067	3.687	0.0152	1.050	0.3080	0.0668			
5	0.3884	0.5807	21.040	1.029	8.088	0.3450	0.2990	2.057	3.655	0.0149	1.048	0.3034	0.0660			
6	0.3811	0.5800	21.040	1.024	8.070	0.3436	0.2987	2.044	3.639	0.0144	1.046	0.2942	0.0640			
7	0.3664	0.5800	21.025	1.021	8.068	0.3433	0.2937	2.043	3.631	0.0140	1.038	0.2930	0.0629			
8	0.3648	0.5780	20.994	1.009	8.034	0.3428	0.2932	2.042	3.625	0.0136	1.027	0.2926	0.0624			
9	0.3600	0.5752	20.992	1.000	7.995	0.3420	0.2923	2.001	3.620	0.0134	0.991	0.2898	0.0617			
10	0.3530	0.5750	20.964	0.998	7.994	0.3390	0.2891	1.996	3.607	0.0130	0.987	0.2886	0.0600			
11	0.3521	0.5724	20.875	0.995	7.988	0.3390		1.996	3.601	0.0126	0.985	0.2839	0.0600			
12	0.3480	0.5720	20.862	0.989	7.965	0.3360		1.986	3.584	0.0125	0.971	0.2830	0.0598			
13	0.3468	0.5661	20.846	0.987	7.920	0.3350		1.968	3.577	0.0120	0.950	0.2810	0.0460			
14	0.3327	0.5570	20.740	0.986	7.916	0.3215		1.887	3.568	0.0120	0.947	0.2780				
15	0.3163	0.5552	20.720	0.938	7.905	0.3203			3.568	0.0110		0.2736				
16	0.3140	0.5496	20.595		7.865	0.3200			3.564	0.0109		0.2628				
17										0.0100						
18																
19																
20																
Mean	0.3659	0.5736	20.949	1.014	8.017	0.3393	0.2990	2.031	3.627	0.0133	1.018	0.2933	0.0630			
STDV.	0.0323	0.0111	0.162	0.036	0.086	0.0107	0.0070	0.066	0.051	0.0018	0.046	0.0173	0.0064			
Certified	**0.37**	**0.574**	**20.95**	**1.01**	**8.02**	**0.339**	**0.299**	**2.03**	**3.63**	**0.014**	**1.02**	**0.293**	**0.063**			
U_{CRM}	0.02	0.006	0.09	0.02	0.05	0.006	0.005	0.04	0.03	0.001	0.03	0.009	0.004			
Methods	I,W,A	C	I,W	I,W,A	I,W,A	I,W,A	F,W	I,W,A	I,W,A	C,W,I	I,W	I,W,A	I,A,W			

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

Element - Teesside	Middlesbrough, England
TUV Nord-Czech	Brno, Czech Republic
AMG Superalloys UK Ltd	Rotherham, England
Mineral & Metallurgical Laboratories	Bangalore, India
Instytut Metalurgii Zelaza	Gliwice, Poland
Luo Yang Copper Co	Lou Yang, He Nan, China
AnchorCert Analytical	Birmingham, England
TCR Engineering Services Pvt Ltd	Mumbai, India
Scrooby's Laboratory Service CC	Benoni, South Africa
Sheffield Analytical Services Ltd.	Sheffield, England
Metals Technology (Testing) Ltd.	Sheffield, England
Laboratory Testing, Inc.	Hatfield, PA
Tec-Eurolab	Campogalliano, Italy
Universal Scientific Laboratory PTY Ltd	Milperra, NSW, Australia
Genitest Inc.	Montreal, Canada
Raghavendra SpectroMet Laboratory	Bangalore, India
Shanghai Jinyi Test Technology Co. Ltd.	Shanghai, China
Analyticka Laborator, Lithea s.r.o.	Brno, Czech Republic

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.

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

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

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