

Certified Reference Material

Certificate of Analysis

Product ID: MBH-11X 15310 B



Product Description: Cast Iron with Chromium (Chill-Cast)

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	0.018	± 0.002	C	2.63	± 0.03	Co	0.157	± 0.004	Cr	20.7	± 0.3
Cu	2.37	± 0.03	Mn	0.97	± 0.01	Mo	0.92	± 0.02	Ni	4.59	± 0.02
P	0.070	± 0.002	S	0.029	± 0.002	Si	0.99	± 0.02	Ti	0.034	± 0.002
V	0.096	± 0.004	W	0.188	± 0.008						

Indicative Values listed in ppm

Sn (<400)

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.

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

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

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.

- AMG Superalloys UK Ltd - Rotherham, UK
- Anchorcert Analytical - Birmingham, UK
- Dirats Laboratories - Westfield, MA
- Element Materials Technology - Middlesbrough, UK
- Genitest, Inc. - Montreal, Canada
- INCDMNR-IMNR - Pantelimon, Romania
- TUV Nord Czech - Brno, Czech Republic
- Instytut Metalurgii Zelaza - Gliwice, Poland
- Shanghai Jinyi Test Tech Co - Shanghai, China
- LGC Standards - Manchester, NH
- Analyticka Laborator Lithea sro - Brno, Czech Republic
- Mineral & Metallurgical Laboratories - Bangalore, India
- Metals Technology Testing Ltd - Sheffield, UK
- New Hampshire Materials Laboratory, Inc. - Somersworth, NH
- Raghavendra SpectroMet Laboratory - Bangalore, India
- Scrooby's Laboratory Services - Benoni, South Africa
- Sheffield Analytical Services - Sheffield, UK
- TCR Engineering Services Ltd - Mumbai, India
- TEC Eurolab - Campogalliano, Italy
- Universal Scientific Laboratory Pty Ltd - Revesby, Australia
- Luo Yang Copper - Luo Yng, He Nan, China

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 Halkotis, Global Product Manager

October 1, 2021
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	C	Co	Cr	Cu	Mn	Mo	Ni	P	S	Si	Sn	Ti	V
1	0.0109	2.5480	0.1420	19.390	2.2516	0.9035	0.8771	4.5220	0.0586	0.0240	0.9383	0.0248	0.0250	0.0790
2	0.0111	2.5480	0.1470	19.440	2.2800	0.9470	0.8890	4.5500	0.0620	0.0243	0.9474	0.0370	0.0292	0.0895
3	0.0127	2.5830	0.1504	20.630	2.3120	0.9485	0.8933	4.5580	0.0650	0.0249	0.9477		0.0305	0.0912
4	0.0140	2.5927	0.1509	20.730	2.3270	0.9490	0.9000	4.5700	0.0676	0.0254	0.9550		0.0306	0.0913
5	0.0151	2.5950	0.1530	20.740	2.3300	0.9510	0.9028	4.5720	0.0677	0.0257	0.9630		0.0328	0.0914
6	0.0165	2.6000	0.1537	20.766	2.3420	0.9537	0.9034	4.5740	0.0681	0.0260	0.9750		0.0330	0.0922
7	0.0170	2.6010	0.1547	20.770	2.3580	0.9560	0.9073	4.5780	0.0685	0.0275	0.9850		0.0335	0.0927
8	0.0172	2.6100	0.1560	20.851	2.3667	0.9590	0.9090	4.5930	0.0688	0.0280	0.9959		0.0338	0.0930
9	0.0181	2.6240	0.1570	20.853	2.3673	0.9627	0.9100	4.5970	0.0694	0.0280	0.9980		0.0340	0.0954
10	0.0193	2.6320	0.1580	20.877	2.3990	0.9645	0.9175	4.5970	0.0697	0.0281	0.9990		0.0340	0.0954
11	0.0196	2.6350	0.1595	20.915	2.4000	0.9750	0.9180	4.6000	0.0703	0.0289	0.9990		0.0341	0.0956
12	0.0199	2.6400	0.1631	20.920	2.4020	0.9820	0.9190	4.6040	0.0705	0.0292	1.0030		0.0348	0.0966
13	0.0202	2.6447	0.1637	20.951	2.4060	0.9892	0.9200	4.6068	0.0713	0.0296	1.0050		0.0355	0.0973
14	0.0210	2.6560	0.1660	20.960	2.4073	0.9896	0.9210	4.6077	0.0733	0.0312	1.0120		0.0360	0.0974
15	0.0214	2.6890	0.1685	20.973	2.4100	0.9911	0.9427	4.6080	0.0740	0.0315	1.0169		0.0370	0.1009
16	0.0222	2.6910	0.1697	20.998	2.4103	0.9930	0.9715	4.6113	0.0756	0.0316	1.0250		0.0376	0.1010
17	0.0275	2.7510		21.100	2.4410	1.0205	0.9840	4.6220	0.0770	0.0327	1.0260		0.0376	0.1133
18	0.0290			21.620	2.4870	1.0330	0.9870	4.6600	0.0780	0.0350	1.0279		0.0401	0.1205
19										0.0360	1.0710			
20										0.0366				
Mean	0.0185	2.6259	0.1571	20.749	2.3721	0.9705	0.9207	4.5906	0.0697	0.0292	0.9942	0.0309	0.0338	0.0963
STDV	0.0049	0.0519	0.0078	0.5286	0.0580	0.0300	0.0313	0.0307	0.0049	0.0038	0.0338	0.0086	0.0035	0.0090
Certified	0.018	2.63	0.157	20.7	2.37	0.97	0.92	4.59	0.070	0.029	0.99	<0.04	0.034	0.096
U _{CRM}	0.002	0.03	0.004	0.3	0.03	0.01	0.02	0.02	0.002	0.002	0.02		0.002	0.004
Methods	I,O,W,X, G,A	C,G	I,O,W,X, G,A	I,O,W,X, G	I,O,W,X, G,A	I,O,W,X, G,A	I,O,W,X, G,A	I,O,W,X, G,A	I,O,W,X, G	C,O,X,G	I,O,W,X, G	X,I	I,O,W,X, G,A	I,O,W,X, A

	W													
1	0.1505													
2	0.1623													
3	0.1650													
4	0.1683													
5	0.1720													
6	0.1836													
7	0.1853													
8	0.1860													
9	0.1925													
10	0.1935													
11	0.1968													
12	0.1980													
13	0.1985													
14	0.1987													
15	0.2009													
16	0.2010													
17	0.2018													
18	0.2040													
19	0.2140													
20														
Mean	0.1880													
STDV	0.0170													
Certified	0.188													
U _{CRM}	0.008													
Methods	I,O,W,X, G,A													

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