

CERTIFICATE OF ANALYSIS

55X A30J5 (batch A)

Certified Reference Material Information

Type: ALUMINIUM/SILICON/COPPER
(PRESSED POWDER)

Form and Size: Disc, 65mm diameter x 30mm thick

Produced by: RSP Technologies, Delfzijl, Holland

Certified and Supplied by: MBH Analytical Limited

Certified Analysis

Percentage element by weight

Element	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb
Value ¹	4.51	0.722	17.08	0.727	0.213	0.209	0.693	0.084
Uncertainty ²	0.04	0.011	0.10	0.011	0.005	0.005	0.007	0.003

Element	Sn	Ti	Cr	Co	Bi	Be	Ca	P
Value ¹	0.0776	0.070	0.069	0.0396	0.0100	0.0029	0.0053	0.016
Uncertainty ²	0.0016	0.002	0.002	0.0012	0.0009	0.0002	0.0004	0.001

Definitions

- ¹ The certified values are the present best estimates of the true content for each element. Each value is a panel consensus, based on the averaged results of an interlaboratory testing programme, detailed on page 3.
- ² The uncertainty values are generated from the 95% confidence interval derived from the wet analysis results, in combination with a statistical assessment of the homogeneity data, as described on page 2.

Certified by:

MBH ANALYTICAL LIMITED


C Eveleighon 19th December 2005

Method of Preparation

This reference material was produced using commercial-quality elements and master alloys. The melt was rapid-quenched, and the resultant ribbon was milled into powder. The bulk powder was sieved, homogenised, then pressed into a billet which was extruded to bar of the final diameter.

Sampling

Samples for chemical analysis were taken from various positions within the bar. Approximately 10% of all discs were selected for non-destructive homogeneity testing.

Homogeneity

The discs were checked for sample and batch uniformity using an optical emission spectrometer.

Using the combined data for each surface, standard deviation values were derived for each element as an indicator of any non-homogeneity (as determined for the specific sample size taken by the spectrometer).

Chemical Analysis

Analysis was carried out on millings taken from samples representative of the product. It was performed by a panel of laboratories mostly operating within the terms of EN ISO/IEC 17025 - 2000, using documented standard reference methods and validated by appropriate reference materials. The individual values listed overpage are the average of each analyst's results.

Estimation of Uncertainties

Each element certified has been analysed by several laboratories, and 95% half-width confidence intervals ($C_{(95\%)}$) for the resultant mean values have been derived by the method shown on page 3.

As a separate exercise, the degree of non-homogeneity of the batch for each element has been quantified by a programme of non-destructive application testing, discussed above.

The final certified uncertainty for each element has been derived by combining these two factors, using the square-root of the summed squares.

Traceability

Most of the analytical work performed to assess this material has been carried out by laboratories with proven competence, as indicated by their accreditation to a national authority. It is part of the 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 primary reference materials.

Usage

Intended use: With optical emission and X-ray fluorescence spectrometers.

Recommended method of use: Aluminium alloys are generally prepared by machining on a mill or a lathe. However, users are recommended to follow the calibration and sample preparation procedures specified by the relevant instrument manufacturer.

Preparation should be the same for reference materials and the samples for test.

A minimum of five consistent replicate analyses is recommended to provide the necessary sample size. Users are advised to check against possible bias between reference materials and production samples due to differences in metallurgical history, and be aware of possible inter-element effects.

Analytical Data

Percentage element by weight

Sample	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb
1	4.404	0.704	16.95	0.714	0.201	0.201	0.685	0.0822
2	4.48	0.707	16.96	0.717	0.201	0.204	0.687	0.0825
3	4.483	0.708	16.97	0.717	0.207	0.205	0.687	0.0834
4	4.496	0.717	16.99	0.718	0.209	0.205	0.688	0.0835
5	4.50	0.721	17.03	0.724	0.210	0.206	0.688	0.0842
6	4.505	0.729	17.04	0.727	0.216	0.206	0.695	0.0845
7	4.511	0.732	17.08	0.730	0.216	0.208	0.698	0.0849
8	4.516	0.733	17.12	0.731	0.216	0.210	0.699	0.0871
9	4.530	0.735	17.15	0.740	0.221	0.216	0.700	0.0872
10	4.55	0.735	17.19	0.752	0.222	0.217	0.705	
11	4.598		17.20		0.225	0.224		
12	4.601		17.33					
Mean	4.514	0.722	17.08	0.727	0.213	0.209	0.693	0.0844
Std Dev	0.053	0.012	0.12	0.012	0.008	0.007	0.007	0.0018
C _(95%)	0.034	0.009	0.07	0.009	0.005	0.005	0.005	0.0014

Sample	Sn	Ti	Cr	Co	Bi	Be	Ca	P
1	0.0741	0.0667	0.0646	0.0356	0.0075	0.0025	0.0047	0.0153
2	0.0757	0.0671	0.0655	0.0373	0.0088	0.0025	0.0048	0.0154
3	0.0768	0.0674	0.0656	0.0388	0.0095	0.0027	0.0048	0.0154
4	0.0773	0.0691	0.0689	0.0388	0.0097	0.0028	0.0050	0.0157
5	0.0775	0.0695	0.0700	0.0392	0.0099	0.0030	0.0050	0.016
6	0.0780	0.0705	0.0701	0.0392	0.0102	0.0030	0.0054	0.0165
7	0.0788	0.0707	0.0702	0.0396	0.0105	0.0030	0.0058	
8	0.0792	0.0713	0.0705	0.0403	0.0107	0.0031	0.0059	
9	0.0812	0.0713	0.0716	0.0412	0.0114	0.0031	0.0060	
10		0.0714	0.0723	0.0415	0.0120	0.0031		
11		0.0742	0.0723	0.0415		0.0033		
12				0.0419				
Mean	0.0776	0.0699	0.0692	0.0396	0.0100	0.0029	0.0053	0.0157
Std Dev	0.0021	0.0023	0.0028	0.0019	0.0013	0.0003	0.0005	0.0005
C _(95%)	0.0016	0.0015	0.0019	0.0012	0.0009	0.0002	0.0004	0.0005

Note: C_(95%) is the 95% half-width confidence interval derived from the equation:

$$C_{(95\%)} = (t \times SD) / \sqrt{n}$$

where n is the number of available values, t is the Student's t value for n-1 degrees of freedom, and SD is the standard deviation of the test results.

Participating Laboratories

Bodycote Materials Testing Ltd
Sheffield Assay Office
Universal Scientific Laboratory Pty
Laboratory Testing, Inc
Institute of Iron & Steel Technology
Luo Yang Copper
South-West Aluminium Group
RWTUV Laboratory
TCR Engineering Services Ltd
Sargam Metals Pvt Ltd
Spectroscopic Solutions Ltd
Genitest Inc
Thermo Electron SA

Middlesbrough, England
Sheffield, England
Milperra, NSW, Australia
Hatfield, PA, USA
Shanghai, China
Luo Yang, He Nan, China
Chonquin, SiChuan, China
Brno, Czech Republic
Mumbai, India
Chennai, India
Western Cape, South Africa
Montreal, Canada
Ecublens, Switzerland

UKAS accreditation 0239
UKAS accreditation 0012
NATA accreditation 0492
A2LA accreditation 0117
CNAL accreditation 0783
CNAL accreditation 0173
CNAL accreditation 0007
CAI accreditation 1060
NABL accreditation 0367
NABL accreditation 0025

Note: to achieve National Accreditation (eg UKAS, NATA, A2LA, CNAL, CAI, NABL), test houses are required to demonstrate conformity to the general requirements of EN ISO/IEC 17025.

Analytical Methods Used

ELEMENT	RESULT No. & METHOD			
	ICP-AES	FAAS	OTHER	
Copper	1, 3, 4, 7, 10-12	2, 5, 6, 9	8	volumetric (thiosulfate)
Magnesium	1, 3, 6-8	2, 4, 5, 9, 10		
Silicon	3, 4, 6, 8, 11	-	1, 2, 7, 9, 10, 12	gravimetric (perchloric acid)
			5	photometric (molybdenum blue)
Iron	1, 3-6, 8, 10	9	2, 7	photometric (orthophenanthroline)
Manganese	4-7, 9, 11	1, 3	2, 8, 10	photometric (periodate)
Nickel	1, 5-9, 11	2, 3, 10	4	photometric (DMGO, α -fural dioxime)
Zinc	1-4, 8	5-7, 9, 10		
Lead	2, 4-8	1, 3, 9		
Tin	2-8	1	9	photometric (phenylfluorone)
Titanium	2, 4, 7-9, 11	3, 10	1, 6	photometric (di-antipyryl methane)
			5	photometric (hydrogen peroxide)
Chromium	1, 2, 6-9, 11	3-5, 10		
Cobalt	3-6, 8, 11, 12	1, 2, 7, 9, 10		
Bismuth	2, 3, 7-9	1, 5, 10	4, 6	volumetric (iodide)
Beryllium	3, 6, 7, 9-11	2, 4, 5	1, 8	photometric (eriochrome cyanine R)
Calcium	1-4, 7, 8	5, 6, 9		
Phosphorus	1, 3, 6	-	2, 4, 5	photometric (molybdenum blue)

Notes

This Certified Reference Material has been produced and certified in accordance with the requirements of ISO Guide 34-2000, ISO Guide 31-2000 and ISO Guide 35-1989, taking into account the requirements of ASTM E1724 and the ISO Guide to the Expression of Uncertainty in Measurement (GUM).

This certification is applicable to the whole of the disc although, in accordance with normal practice for OES use, it may be appropriate to avoid using the central area, of approximately 12mm diameter.

This material will remain stable provided adequate precautions are taken to protect it from cross-contamination, extremes of temperature and atmospheric moisture. All production records will be retained for a period of 20 years from the date of original analysis. This certification will therefore expire in December 2025, although we reserve the right to make changes as issue revisions, in the intervening period.

This sample is also available in the form of chippings.

The specification, preparation, analysis and certification of this product were supervised by C Eveleigh, PhD, Technical Director, MBH Analytical Ltd.

The material to which this certificate of analysis refers is supplied subject to our general conditions of sale.