

CERTIFICATE OF ANALYSIS

66X MGC4 (batch C)

Certified Reference Material Information

Type: MAGNESIUM / ZINC (CAST)
Form and Size: Disc 40-50mm Diameter x 15-20mm Thickness
Produced by: MBH Analytical Ltd
Certified and supplied by: MBH Analytical Ltd

Certified Analysis

Percentage element by weight

Element	Al	Zn	Mn	Cu	Si	Fe	Ni
Value ¹	0.039	6.80	0.167	0.0023	0.06	0.006	0.001
Uncertainty ²	0.006	0.15	0.010	0.0005	0.01	0.001	0.0002

Element	Sn	Pb	Zr	Be	Ag	Sr	Ca
Value ¹	0.021	0.003	<0.001	0.0001	0.0074	0.0001(4)	<0.001
Uncertainty ²	0.003	0.0005	-	-	0.0004	-	-

Note: values given in parentheses are not certified - they are provided for information only.

Definitions

- ¹ The certified values are derived from the 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 (page 3). When appropriate, these values have been modified to account for additional information from the material homogeneity checks.

Certified by:

MBH ANALYTICAL LIMITED _____ on 19th July 2001

Method of Preparation

This reference material was produced from master alloys and commercial-purity magnesium. The metal was cast by sequential transfer of aliquots from the melt holding pot into individual iron chill moulds. At least 1mm was machined from the upper and lower surfaces of each disc, to minimise surface effects.

Sampling

Samples for chemical analysis and discs for homogeneity checks were taken from several positions throughout the casting process.

Homogeneity

Discs were checked for uniformity using an optical emission spectrometer. One additional disc was checked for vertical uniformity using the same method.

Multiple measurements were taken from each surface under test, and averaged.

The mean value of the material was then calculated from these averages.

For each of the surfaces checked, the differences between the averaged result and the overall mean value were evaluated to ensure that the homogeneity of the material satisfied the acceptance criteria defined in ISO guide 30 - 1992, and fell within 95% probability limits.

Note: throughout the batch, zinc shows a high spark-to-spark variability, with an RSD around 5-6%. This is an unavoidable feature within castings of this alloy type, which can be compensated by taking at least five sparks per sample.

Chemical Analysis

Analysis was carried out on millings taken from samples representative of the product. It was performed by participating laboratories mostly operating within the terms of EN ISO/IEC 17025 - 2000, using documented standard methods of analysis.

The individual values listed overpage are the average of each analyst's results.

Usage

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

Recommended method of use: Magnesium and magnesium alloys are generally prepared by milling or turning on a lathe, avoiding the use of lubricants and ensuring that 'sparking' does not occur during the process. 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, and should be done immediately prior to analysis to minimise the effects of surface oxidation.

A minimum of five consistent replicate analyses is recommended to optimise precision and accuracy. 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	Al	Zn	Mn	Cu	Si	Fe	Ni
1	0.031	6.69	0.15	0.0015	0.040	0.0046	0.0007
2	0.035	6.74	0.155	0.0016	0.05	0.005	0.0008
3	0.037	6.78	0.16	0.002	0.050	0.006	0.001
4	0.037	6.80	0.162	0.0024	0.06	0.006	0.001
5	0.040	6.84	0.17	0.0025	0.062	0.006	0.0011
6	0.0427	6.88	0.18	0.0025	0.065	0.007	<0.001
7	0.043	6.90	0.18	0.003	0.070	0.007	
8	0.05		0.181	0.003		0.007	
9						0.0083	
Mean	0.039	6.80	0.167	0.0023	0.057	0.0063	0.0009
Std Dev	0.006	0.08	0.012	0.0006	0.010	0.0011	0.0002
C (95%)	0.005	0.07	0.010	0.0005	0.010	0.0009	0.0002

Sample	Sn	Pb	Zr	Be	Ag	Sr	Ca
1	0.015	0.002	<0.0001	0.0001	0.007	0.0001	0.0002
2	0.0184	0.0024	<0.001	0.0001	0.0070	0.0001	<0.0005
3	0.020	0.003	<0.001	0.0001	0.0073	0.0001	0.0006
4	0.0204	0.003	<0.001	0.0001	0.0074	0.0002	<0.001
5	0.022	0.0030	<0.001	0.0001	0.0075	0.0002	
6	0.024	0.003	<0.01	0.0002	0.008	<0.0005	
7	0.024	0.0036		<0.0005			
8	0.025			<0.0005			
Mean	0.021	0.0029	<0.001	0.0001	0.0074	0.00014	<0.001
Std Dev	0.003	0.0005	-	-	0.0004	0.00005	-
C (95%)	0.003	0.0005	-	-	0.0004	0.00007	-

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

Metals Technology Testing Ltd	Sheffield, England	UKAS approval 0963
University Metals Advisory Centre	Sheffield, England	UKAS approval 0041
Bodycote Materials Testing Ltd	Middlesbrough, England	UKAS approval 0239
RoTech Laboratories	Wednesbury, England	UKAS approval 0366
Sheffield Assay Office	Sheffield, England	UKAS approval 0012
London & Scandinavian Met Co Ltd	Rotherham, England	UKAS approval 1091
Laboratory Testing Inc	Hatfield, Pa, USA	A2LA accreditation 0117
Universal Scientific Laboratory Pty Ltd	Milperra, NSW, Australia	NATA accreditation 0492
Central Iron & Steel Research Inst	Beijing, China	National reg. E0584

Analytical Methods Used

Aluminium:	FAAS	ICP	
Zinc:	FAAS	ICP	volumetric (EDTA)
Manganese:	FAAS	ICP	photometric (periodate)
Copper:	FAAS	ICP	
Silicon:	FAAS	ICP	photometric (molybdenum blue)
Iron:	FAAS	ICP	photometric (1,10-phenanthroline)
Nickel:	FAAS	ICP	photometric (dimethyl glyoxime)
Tin:	FAAS	ICP	photometric (phenyl fluorone)
Lead:	FAAS	ICP	polarographic
Zirconium:	FAAS	ICP	
Beryllium:	FAAS	ICP	
Titanium:	FAAS	ICP	
Silver:	FAAS	ICP	
Strontium:	FAAS	ICP	
Calcium:	FAAS	ICP	

Notes

Safety Finely-divided magnesium may ignite. Machining tools should be kept sharp to ensure the frictional heat at the tip does not ignite the chips produced. Sand should be available in the event of a fire. Water should never be used.

In OES the sample should be of sufficient mass to prevent excessive heating during sparking and the discharge chamber should be regularly cleaned as directed by the instrument manufacturer.

Precautions should be taken to protect this material from extremes of temperature and atmospheric moisture. However, it is not chemically stable, and will quickly develop a non-metallic surface film under normal storage conditions.

This Certified Reference Material has been produced in accordance with the requirements of ISO Guide 34-2000, ISO Guide 31-2000, ISO Guide 35-1989, and ASTM Guides E1724 and E1831.

To achieve UKAS (UK Accreditation Scheme) approval, test houses must demonstrate conformity to the general requirements of EN ISO/IEC 17025 and ISO9002.

The combination of alloying elements used in a complex cast material of this type, coupled with the unidirectional solidification effects associated with semi-chill casting, may lead to the formation of inhomogeneous segregates in the rear portion of the disc. The above certification is therefore only applicable from the front face of the disc. Material to the rear of the disc, to a depth of 5mm, is not certified.

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