

CERTIFICATE OF ANALYSIS

65X MGA1 (batch J)

Certified Reference Material Information

Type: MAGNESIUM / ALUMINIUM / ZINC (CAST)
Form and Size: Disc 45mm Diameter x 20mm Thickness
Produced by: KRR Metals Ltd
Certified and supplied by: MBH Analytical Ltd

Certified Analysis

Percentage element by weight

Element	Al	Zn	Mn	Cu	Si	Fe	Ni	Ca	Sn
Value ¹	5.45	1.26	0.060	0.221	0.20	0.021	0.021	0.029	0.072
Uncertainty ²	0.05	0.04	0.010	0.010	0.03	0.005	0.002	0.005	0.005

Element	Pb	Zr	Be	Ag	Cd	Ti	Ce	La
Value ¹	0.012	(0.0015)	0.006	0.012	0.013	(0.005)	0.009	0.007
Uncertainty ²	0.002	-	0.001	0.001	0.002	-	0.001	0.001

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 29th August 2001

Method of Preparation

This reference material was produced from master alloys and commercial-grade magnesium. All discs are the product of one melt, which was cleaned under a low-melting flux and poured into cylindrical steel moulds. Each stick was sliced to yield several discs.

Sampling

Milled samples for chemical analysis were taken from several positions throughout the casting process. Solid samples were also taken throughout the pour for homogeneity evaluation, and a single stick was sectioned for vertical and lateral checks.

Homogeneity

Each sample was checked for uniformity using an optical emission spectrometer.

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 met the acceptance criteria defined in ISO guide 30 - 1992.

Chemical Analysis

Analysis was carried out on millings taken from samples representative of the cast product. For analysis purposes, the selected participating laboratories normally followed the requirements of ISO guide 25 - 1990. 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	Ca	Sn
1	5.41	1.215	0.047	0.21	0.15	0.016	0.0175	0.024	0.0639
2	5.44	1.25	0.058	0.21	0.17	0.018	0.0213	0.025	0.068
3	5.45	1.25	0.0597	0.215	0.17	0.020	0.022	0.0277	0.068
4	5.474	1.26	0.0598	0.215	0.198	0.0218	0.022	0.031	0.07
5	5.48	1.28	0.062	0.222	0.203	0.024	0.022	0.032	0.0731
6		1.29	0.062	0.23	0.219	0.027	0.024	0.035	0.075
7		1.295	0.072	0.231	0.223				0.077
8				0.234	0.25				0.079
Mean	5.45	1.263	0.060	0.221	0.198	0.021	0.021	0.029	0.072
Std Dev	0.03	0.028	0.007	0.010	0.033	0.004	0.002	0.004	0.005
C_(95%)	0.03	0.026	0.007	0.008	0.028	0.004	0.002	0.004	0.004

Sample	Pb	Zr	Be	Ag	Cd	Ti	Ce	La
1	0.010	0.0010	0.0043	0.011	0.010	0.0035	0.008	0.0066
2	0.011	0.0013	0.005	0.0113	0.011	0.004	0.0084	0.007
3	0.0121	0.0013	0.005	0.012	0.0124	0.005	0.0090	0.0074
4	0.013	0.002	0.0064	0.012	0.014	<0.005	0.0095	0.0080
5	0.0138	0.002	0.0065	0.0124	0.015	0.006		
6	0.015	<0.01	0.007	0.014	0.015	0.0069		
7			0.0074	0.014	0.0154			
Mean	0.012	0.0015	0.0059	0.012	0.013	0.0051	0.0087	0.0073
Std Dev	0.002	0.0005	0.0012	0.001	0.002	0.0014	0.0007	0.0006
C_(95%)	0.002	0.0006	0.0011	0.001	0.002	0.0017	0.0011	0.0010

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
RoTech Laboratories Ltd
Bodycote Materials Testing Ltd
Birmingham Assay Office
Cominsa Corp de Investigacion
Laboratory Testing Inc
Central Iron & Steel Res Inst
Shiva Analyticals Ltd
Thermo-ARL

Sheffield, England
Wednesbury, England
Middlesbrough, England
Birmingham, England
Saltillo, Coah, Mexico
Hatfield, Pa, USA
Beijing, China
Bangalore, India
Ecublens, Switzerland

NAMAS approval 0963
NAMAS approval 0366
NAMAS approval 0239
NAMAS approval 0667
EMA accred. Q-014-053
A2LA approval 0117
National reg. E0584

Analytical Methods Used

Aluminium:	FAAS	ICP	volumetric (EDTA)	
Zinc:	FAAS	ICP	volumetric (EDTA)	
Manganese:	FAAS	ICP	photometric (periodate)	
Copper:	FAAS	ICP	photometric (neocuprone/trichloromethane)	
Silicon:	FAAS	ICP	photometric (molybdenum blue)	
Iron:	FAAS	ICP		
Nickel:	FAAS	ICP		
Calcium:	FAAS	ICP		
Tin:	FAAS	ICP	photometric (phenylfluorone)	
Lead:	FAAS	ICP	square-wave polarography	
Zirconium:	FAAS	ICP	photometric (arsenazo III)	OES
Beryllium:	FAAS	ICP	photometric (beryllon III)	
Silver:	FAAS	ICP	photometric (dithizone)	
Cadmium:	FAAS	ICP		
Titanium:	FAAS	ICP	OES	
Cerium:		ICP		
Lanthanum:		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.

This product was originally certified in June 2000. The certificate has been revised to incorporate some additional results, and has been re-formatted for clarity, and to ensure compliance with ISO Guide 31 - 2000. Otherwise, this Certified Reference Material has been produced in accordance with the general principles of ISO Guide 34 - 1996.

To achieve NAMAS (UK National Measurement Accreditation Scheme) approval, test houses were required to demonstrate conformity to the general requirements of BS EN 45001, ISO Guide 25 and ISO9002.

For OE work, in accordance with normal practice it is recommended that the central portion of the disc is not used for analysis. Otherwise, this certification is applicable to the whole of the disc.

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.

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