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Evaluation method for cleanliness of magnesium and magnesium alloy ingots

Méthode d'évaluation de la propreté des lingots en magnésium et en alliages de magnésium

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 5, *Magnesium and alloys of cast or wrought magnesium*.

Evaluation method for cleanliness of magnesium and magnesium alloy ingots

1 Scope

This document describes a method to evaluate the cleanliness and the quality of magnesium and magnesium alloys ingots.

The method includes naked eye inspection, the composition analysis and a brightness evaluation procedure based on an ISO standard.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2470-1, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 1: Indoor daylight conditions (ISO brightness)*

ISO 3116, *Magnesium and magnesium alloys — Wrought magnesium alloys*

ISO 8287, *Magnesium and magnesium alloys — Unalloyed magnesium — Chemical composition*

ISO 16220, *Magnesium and magnesium alloys — Magnesium alloy ingots and castings*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Naked eye inspection

Identify any presence of significant contraction or impurities on the surface of magnesium ingots. The decision on the quality of ingots by naked eye inspection should be agreed between the supplier and the purchaser.

5 Chemical composition analysis

Analyse the content of alloying elements of ingots. The chemical composition methods can be selected by agreement between the supplier and the purchaser and shall be mentioned in the testing report. The chemical composition of magnesium and magnesium alloys is specified in ISO 8287, ISO 16220 and ISO 3116. The range of the composition of unspecified alloys or alloying elements can be determined by an agreement between the supplier and the purchaser.

6 Brightness evaluation

6.1 Principle of brightness evaluation

The principle of the brightness evaluation is based on the specification given in ISO 2470-1. Diffused light beams from a standard testing machine are shed on a specimen. Beams reflected from the specimen surface pass through a specified glass filter and are subsequently measured by an optical cell or arranged diodes that respond to different effective wavelengths. The brightness can be evaluated directly from the output of the optical cell or obtained by assessment of the output from the diodes using an appropriate weight function.

6.2 Specimen preparation

In principle, the test specimen should be obtained directly from ingots or molten metals. The shape and dimension of the test specimen are shown in Figure 1. The specimen is machined directly from the ingot in use. When the specimen is obtained from molten metals, it is prepared by pouring the melt in a mould having appropriate shape and dimensions. In this case, the dimensions can be slightly modified except that of the neck area, which shall have 8 mm diameter since it is the dimension area of the testing machine.

Dimensions in millimetres

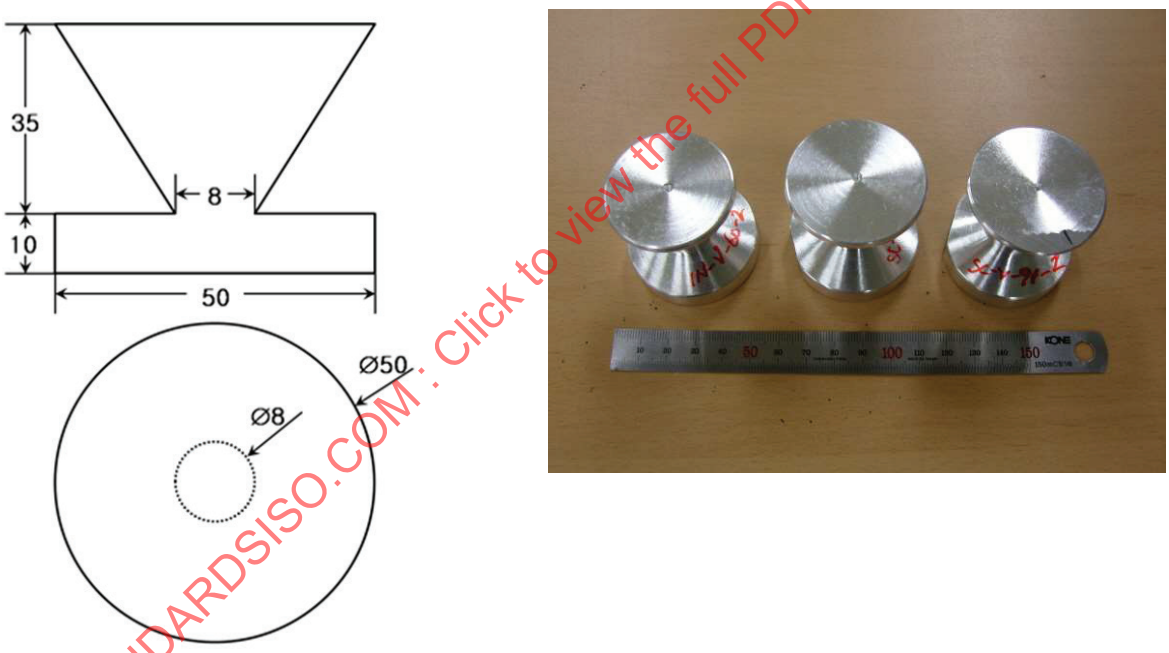


Figure 1 — Shape and dimension of the test specimen obtained by machining from ingots

Figure 2 shows the shape and dimension of the mould to cast the brightness test specimen. The dimension of the inside area is the same as that shown in Figure 1. The design of the mould can be modified freely; it can be designed as a separate type such that the specimen is easily released as shown below.

Dimensions in millimetres

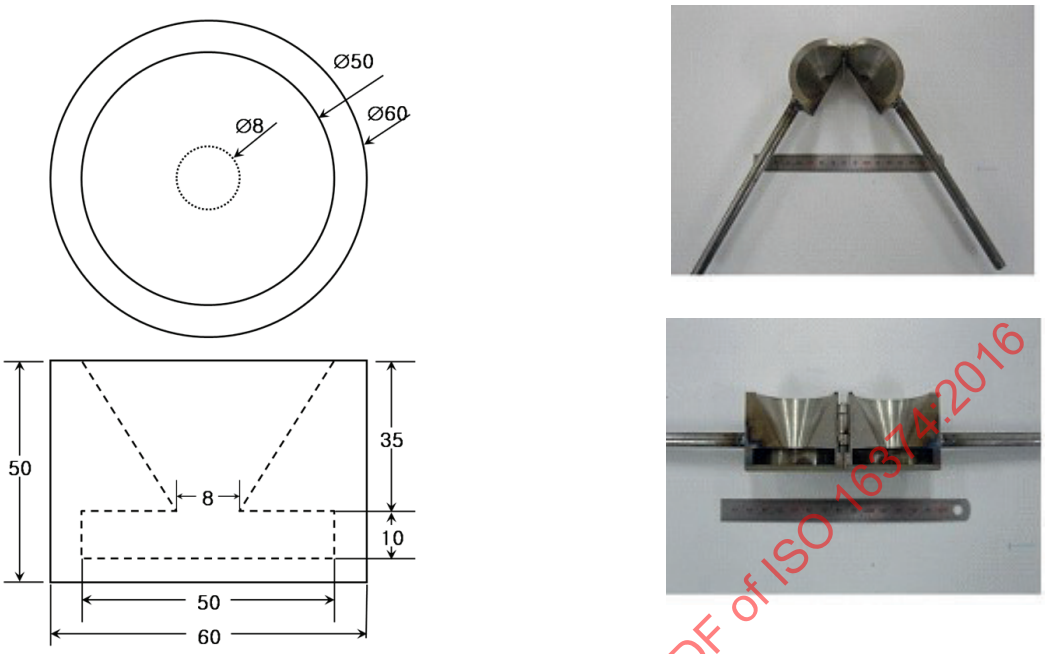
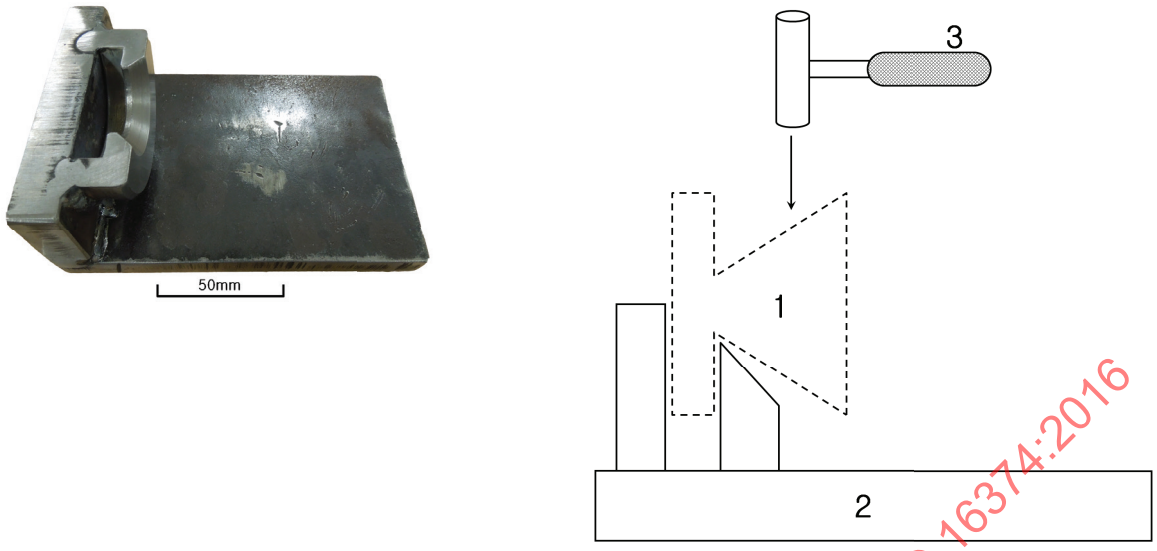


Figure 2 — Shape and dimension of mould for brightness test specimen from molten metals

6.3 Shape of jig

A jig is used to break the neck area for brightness tests. Such a jig can be prepared in various ways with freedom so that the neck area can be fractured by repeated impacts. The outline of the jig shape is shown in Figure 3.



Key

1 specimen
2 jig for fracture
3 hammer

Figure 3 — Shape of jig and setup for fracturing the test specimen

6.4 Brightness evaluation of the fracture surface

Immediately after the fracture of the test specimen, the brightness of the fracture surface is evaluated by means of an appropriate instrument while rotating the specimen. The number of determination depends on rotation angles as shown in Table 1. The final result is expressed by the average value of the test results obtained at each angle. The number of test specimen and determinations shall be specified by agreement between the supplier and the purchaser.

Table 1 — Number of determinations and rotation angles to evaluate brightness of fracture surface

No. of measurement	Rotation angle for each measurement
3	0°, 45°, 90°
8	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°

The criteria to evaluate brightness for each alloy is shown in Table 2. The brightness data for alloys that are not shown in Table 2 can be deduced from the contents of major alloying elements and finally determined according to the agreements between the deliverer and the acceptor.

Table 2 — Criteria to evaluate brightness for each alloy

Materials	Criteria for brightness	Major alloying element and its range	Alloy designation	
			ISO	ASTM
Mg-9Al-1Zn	above 48	Al 9,0 ~ 11,0	MgAl9Zn1(B)	AZ91C
			MgAl9Zn1(A)	AZ91E
				AZ91B
				AZ91D
Mg-6Al-0,5Mn, Mg-5Al-0,5Mn	above 50	Al 5,0 ~ 7,5	MgAl6Mn	AM60B
			MgAl5Mn	AM50A
Mg-3Al-1Zn	above 51	Al 3,0 ~ 5,0	MgAl3Zn1(A)	AZ31A
			MgAl3Zn1(B)	AZ31B

6.5 Others

In the case that there is a difficulty to obtain the full-specimen dimension by machining or casting, the brightness can be evaluated by directly breaking the ingots or castings after agreement between the supplier and the purchaser. In this case, the diameter of the fractured surface should be at least 8 mm and recorded in final report in detail.

7 Test report

The test report shall include the following information:

a) the date of the test, identification of the testing organization and signature of the responsible person;

b) the identification of the manufacturer, alloy designation, number of test specimens and number of test specimens;

c) the identification of the sample;

d) the specimen preparation method: casting, machining;

e) the criteria for naked eye inspection and results;

f) the chemical composition analysis method and results;

g) the type of instrument used for the brightness evaluation: manufacturer, model;

h) the conditions to evaluate the brightness of fractured surfaces;

i) the results of brightness evaluation;

j) any departure from this document or any circumstances or influences that may affect the results.