



JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
Japanese Standards Association

---

---

**JIS H 1305** : 2005

(JAA/JSA)

**Method for optical emission  
spectrochemical analysis of  
aluminium and aluminium alloys**

---

ICS 77.120.10

Reference number : JIS H 1305 : 2005 (E)

PROTECTED BY COPYRIGHT



**Documents**

Document Sharing Hub

11 S

## Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Aluminium Association (JAA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS H 1305 : 1976** is replaced with this Standard.

Date of Establishment: 1965-10-01

Date of Revision: 2005-03-20

Date of Public Notice in Official Gazette: 2005-03-22

Investigated by: Japanese Industrial Standards Committee  
Standards Board  
Technical Committee on Non-Ferrous  
Metals

---

JIS H 1305:2005, First English edition published in 2005-10

Translated and published by: Japanese Standards Association  
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

---

In the event of any doubts arising as to the contents,  
the original JIS is to be the final authority.

© JSA 2005

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

## Contents

|                                                                                                                                                                                                                          | Page |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| 1 Scope .....                                                                                                                                                                                                            | 1    |
| 2 Normative reference .....                                                                                                                                                                                              | 1    |
| 3 General requirements .....                                                                                                                                                                                             | 1    |
| 4 Elements to be determined and concentration range .....                                                                                                                                                                | 1    |
| 5 Definitions .....                                                                                                                                                                                                      | 2    |
| 6 Summary .....                                                                                                                                                                                                          | 3    |
| 7 Apparatus .....                                                                                                                                                                                                        | 3    |
| 7.1 Emission spectrophotometer .....                                                                                                                                                                                     | 3    |
| 7.2 Adjustment of apparatus .....                                                                                                                                                                                        | 3    |
| 7.3 Apparatus performance criteria .....                                                                                                                                                                                 | 3    |
| 8 Standard substance, sample for calibration of working curve and analytical sample .....                                                                                                                                | 4    |
| 9 Preparation for sample .....                                                                                                                                                                                           | 5    |
| 10 Operation .....                                                                                                                                                                                                       | 5    |
| 11 Preparation of working curve .....                                                                                                                                                                                    | 5    |
| 12 Test of working curve .....                                                                                                                                                                                           | 7    |
| 13 Calibration of working curve .....                                                                                                                                                                                    | 8    |
| 14 Calculation .....                                                                                                                                                                                                     | 9    |
| Annex (normative) Method for optical emission spectrochemical analysis of aluminium and aluminium alloys (in the case using an optical emission spectrometer with an atmospheric air discharge luminescence stand) ..... | 12   |

## Method for optical emission spectrochemical analysis of aluminium and aluminium alloys

**1 Scope** This Japanese Industrial Standard specifies the method for optical emission spectrochemical analysis with an argon-atmosphere discharge luminescence stand of aluminium and aluminium alloys. This Standard applies to the determination of components given in table 1.

In addition, the method for optical emission spectrochemical analysis with an atmospheric air discharge luminescence stand of aluminium and aluminium alloys is as given in annex.

**2 Normative reference** The following standard contains provisions which, through reference in this text, constitutes provisions of this Standard. The most recent editions of the standard (including amendments) indicated below shall be applied.

JIS Z 2611 *General rules for photoelectric emission spectrochemical analysis of metal materials*

**3 General requirements** The general requirements used in common for analysis shall conform to **JIS Z 2611**.

**4 Elements to be determined and concentration range** The elements to be determined and concentration range shall be as given in table 1.

**Table 1 Elements to be determined and concentration range**

Unit: % (m/m)

| Elements to be determined | Concentration range                |
|---------------------------|------------------------------------|
| Silicon                   | 0.001 or over up to and incl. 25.0 |
| Iron                      | 0.001 or over up to and incl. 2.5  |
| Copper                    | 0.001 or over up to and incl. 7.0  |
| Manganese                 | 0.001 or over up to and incl. 3.0  |
| Magnesium                 | 0.001 or over up to and incl. 12.0 |
| Chromium                  | 0.001 or over up to and incl. 0.50 |
| Zinc                      | 0.001 or over up to and incl. 12.0 |
| Titanium                  | 0.001 or over up to and incl. 0.50 |
| Nickel                    | 0.001 or over up to and incl. 3.0  |
| Bismuth                   | 0.001 or over up to and incl. 1.0  |
| Lead                      | 0.002 or over up to and incl. 1.0  |
| Zirconium                 | 0.001 or over up to and incl. 0.50 |
| Gallium                   | 0.002 or over up to and incl. 0.10 |
| Vanadium                  | 0.002 or over up to and incl. 0.25 |
| Tin                       | 0.001 or over up to and incl. 6.0  |
| Boron                     | 0.001 or over up to and incl. 0.25 |
| Beryllium                 | 0.001 or over up to and incl. 0.10 |

**5 Definitions** For the purpose of this Standard, the following definitions apply.

- metallurgical conditions** conditions such as the rate of solidification of a molten metal sample which affects the form of metallographic structure and deposit and inclusion and the emission intensity measurements even if the chemical composition of a analytical sample is the same, the heating temperature when heat treatment and rolling and forging are performed
- emission intensity measurements** the emission intensity of the component to be determined by an optical emission spectrochemical analysis method in the case of an emission intensity method, or the ratio of the emission intensity of the component to be determined to the emission intensity of an internal standard element (generally aluminium) in the case of an intensity ratio method
- percentage content ratio method** the method to obtain the quantitative value of the component by canceling the correction after obtaining the corrected percentage content ratio of the component from the emission intensity ratio of the component in the sample by correcting the standard value of the component to be determined to be the percentage content ratio to the percentage content of aluminium and by obtaining the relation curve of the emission intensity ratio to the corrected percentage content ratio to make the working curve when preparing the working curve using the aluminium standard substance for instrumental analyses, etc.

**6 Summary** After cutting or machining a sample, grind it to finish so that it becomes planate, attach it to the sample holder of an emission spectrophotometer to make it be an electrode, use tungsten for a counter electrode, discharge between the both electrodes by applying voltage, obtain spectral lines by a spectrometer, and measure the spectral line intensity of the component to be determined.

## 7 Apparatus

**7.1 Emission spectrophotometer** The emission spectrophotometer shall be in accordance with **JIS Z 2611** and as follows:

- a) **Counter electrode** For the counter electrode, the electrode obtained by forming the head of a tungsten rod of 0.5 mm to 7 mm in diameter so as to have the shape of the truncated cone with the conical shape of 20° to 120° or the plane surface of 1 mm in diameter shall be used.
- b) **Argon** Argon of not less than 99.99 % (m/m) in purity with few oxygen, hydrocarbon and other impurities shall be used<sup>(1)</sup>.

Note <sup>(1)</sup> The purity has a significant effect on the quantitative value. That is, be careful since the stability of repeated measurements is lowered, the measurements of emission intensity are decreased due to poor discharge, etc. by using argon with many impurities.

**7.2 Adjustment of apparatus** The adjustment of apparatus shall be performed in accordance with **JIS Z 2611**. However, for the pressure inside the spectrometer, the optimal conditions for each analyzer shall be applied.

**7.3 Apparatus performance criteria** The apparatus performance criteria shall be as follows:

- a) For the emission spectrophotometer adjusted in accordance with **7.2**, the analysis conditions (analytical lines, excitation conditions, photometry conditions, etc.) shall be set so that repeatability and sensitivity may become suitable.
- b) Repeatability shall be not more than the upper limit of the relative standard deviation specified in table 2. However, it shall not be applied to an Al-Si system hypereutectic alloy sample<sup>(2)</sup>.

In addition, the relative standard deviation refers to the value calculated according to the following formula after obtaining the quantitative value for every measurement by measuring the emission intensity of a homogeneous sample, for example the aluminium standard substance for instrumental analyses in accordance with clause **10** at least 6 times.

$$RSD = \frac{\sigma}{\bar{x}} \times 100$$

where, *RSD* : relative standard deviation

$\sigma$  : standard deviation of the quantitative value obtained by measuring the same sample repeatedly

$\bar{x}$  : average value of the quantitative value obtained by measuring the same sample repeatedly