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(JAPA/JSA)

**Anodizing of aluminium and its alloys—
Measurement of abrasion resistance
of anodic oxidation coatings—Part 1:
Abrasive-wheel-wear abrasion
resistance test**

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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 Products Association (JAPA)/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 8682-1:1999** is replaced with this Standard.

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JIS H 8682 series consists of the following 3 parts under the general title “*Anodizing of aluminium and its alloys—Measurement of abrasion resistance of anodic oxidation coatings*”:

Part 1: Abrasive-wheel-wear abrasion resistance test

Part 2: Abrasive jet abrasion resistance test

Part 3: Falling sand abrasion resistance test

Anodizing of aluminium and its alloys— Measurement of abrasion resistance of anodic oxidation coatings— Part 1: Abrasive-wheel-wear abrasion resistance test

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 8251** published in 2011 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies the method for testing the wear characteristics such as wear resistance by abrading (reciprocal motion) the surface of flat and smooth anodic oxidation coatings exceeding 5 µm in thickness (hereafter referred to as “coatings”) applied to the products manufactured from aluminium and aluminium alloys (hereafter referred to as “products”) with abrasive paper.

NOTE 1 There are an abrasive-wheel-wear abrasion resistance test, abrasive jet abrasion resistance test and falling sand abrasion resistance test in the test methods. In this Standard, an abrasive-wheel-wear abrasion resistance test method is specified.

NOTE 2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 8251:2011 *Anodizing of aluminium and its alloys—Measurement of abrasion resistance of anodic oxidation coatings* (MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS H 0201 *Glossary of terms used in the surface treatment of aluminium*

JIS H 8680-2 *Test methods for thickness of anodic oxide coatings on aluminium and aluminium alloys—Part 2: Eddy current method*

JIS R 6252 *Abrasive papers*

JIS Z 8401 *Guide to the rounding of numbers*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS H 0201, and the following apply.

3.1 test specimen

specimen for testing the wear characteristics such as wear resistance

3.2 standard specimen

specimen to correct the discrepancy of test results caused by the difference in test apparatus, lot of abrasive paper used or the like for the comparison with the test specimen

3.3 reference specimen

specimen prepared under the condition agreed between the purchaser and the manufacturer, which is used for the reference to the test specimen

3.4 double stroke, ds

one reciprocal motion of abrasion made between the abrasive wheel and the test specimen

The number of reciprocal motions is expressed by "ds".

NOTE : In this test, the wear characteristics are evaluated by measuring the amount of wear corresponding to the number of double strokes that is equal to the number of reciprocal motions of abrasion required for abrading coatings.

4 Feature

This test gives the method for obtaining the wear characteristics of coatings by abrading in which a specified pressure is applied between an abrasive paper and a test specimen. The wear resistance, the wear index and the like of the oxide layer near the surface, of the whole coatings or of any selected intermediate layer may be determined.

NOTE : This test is applicable to the smooth and flat coatings exceeding 5 µm in thickness applied to the smooth and flat aluminium or its alloy specimens; however, this method is not applicable to concave or convex test specimens or curved test specimens. These may be examined using the abrasive jet abrasion resistance test method which will give an average value for the wear resistance of coatings (see **JIS H 8682-2**).

5 Summary

In this test, the abrasive-wheel-wear test apparatus is employed, and the reciprocal motion is made by applying a specified pressure between the test specimen and the abrasion wheel on which silicon carbide abrasive paper is attached circumferentially. Every time one reciprocal motion is finished, the abrasion wheel is rotated by an angle of 0.9° to make the fresh part of abrasive paper during abrasion appear while it is being in contact with the abraded surface of the test specimen, then the test is repeated.

For the test results, the loss in coating thickness or the loss in mass is measured, and the wear resistance, wear index, etc. is calculated as compared with the standard specimen (Annex A or Annex JA) or the reference specimen (3.3).

When the coating thickness cannot be measured by the measuring instrument for coating thickness, the loss in mass method should be applied.

If the relation between the abraded coating thickness and the number of double strokes is represented by a graph, the feature of wear resistance of coatings can be grasped.

NOTE : In order to grasp the change of wear characteristics according to the depth of coatings, the test surface is gradually abraded until the substrate of aluminium appears (see Annex B).

6 Test apparatus and measuring instruments

6.1 Test apparatus The abrasive-wheel-wear test apparatus shall consist of a test specimen supporting stage, abrasive wheel with rotation device, mechanism for abrasive motion, mechanism for applying pressure, reading device of number of abrasions and others whose construction shall be such that the dropped powder from the test specimen or the abrasive paper does not remain on the surface of the test specimen. The requirements in table 1 shall be satisfied. For removing dropped powder, a suction device, etc. may be used. An example of the abrasive-wheel-wear test apparatus is shown in Annex C.

After each one reciprocal motion of the abrasion wheel on the test specimen, before the next abrasion operation, the abrasion wheel shall be advanced through an angle of 0.9° while the silicon carbide abrasive paper is being in contact with the surface of the test specimen. After the number of double strokes reaches 400, the abrasive wheel will have made one complete revolution. At this stage, the silicon carbide paper shall be renewed.

The abrasive-wheel-wear test apparatus should be such that the number of abrasions is recorded on the reading device of number of abrasions and the mechanism for abrasive motion is automatically switched off after a preset number of double strokes has been reached (400 ds maximum).

Table 1 Requirements to be provided with test apparatus

Apparatus	Requirements to be provided
Test specimen supporting stage	That capable of firmly fixing the test specimen, which prevents the shift of test specimen from it due to the reciprocal motion between test specimen and abrasive wheel.
Abrasive wheel with rotation device	That of 50 mm in diameter and 12 mm in width capable of making the rotation of 0.9° in every double stroke (400 ds makes one rotation).
Mechanism for abrasive motion	That capable of abrading with $40 \text{ ds} \pm 2 \text{ ds per minute}$ and $30.0 \text{ mm} \pm 0.5 \text{ mm}$ in stroke, and of making uniform abrasion on test specimen.
Mechanism for applying pressure	That capable of applying specified pressure between abrasive wheel and test specimen.
Reading device of number of abrasions	That capable of reading the number of abrasions accurately, and possibly equipped with automatic switching-off device.

6.2 Abrasive paper The abrasive paper shall be of the grain size P 320 (for ordinary coatings) or P 240 (for hard coatings) of silicon carbide material C specified in **JIS R 6252**, which is cut into $12 \text{ mm} \times 158 \text{ mm}$ and to which an adhesive is applied on its back side.

6.3 Measuring instrument for coating thickness For the measuring instrument for coating thickness, the eddy-current meter specified in **JIS H 8680-2** shall be used.

6.4 Balance The chemical balance or the electronic balance of 0.1 mg in minimum indication shall be used.

7 Test method

7.1 Standard specimen

The standard specimen prepared according to the specification in Annex A or Annex JA shall be used.

7.2 Reference specimen

The reference specimen prepared upon the agreement between the purchaser and the manufacturer shall be used.

7.3 Test specimen

The test specimen shall be as follows.

- A test specimen shall be sampled from the effective surface where the coatings applied on the surface of product absolutely satisfies the quality that suits the application, and the shape of test specimen shall be a flat surface.

When a test specimen cannot be sampled from a product, the test specimen prepared from the same material and under the same treatment condition as those of the product shall be used. The same material as that of the product means that the type/temper and the surface condition before treatment of material are the same

as those of the product. Furthermore, the same treatment condition means that the pretreatment and the coating treatment are performed using the same bath composition of that of the product under the same treatment condition so that the same performance as that of the product can be obtained.

- b) The minimum dimension of test specimen shall be 70 mm × 70 mm.
- c) Previously, the test specimen shall be cleaned using soft absorbent cotton, etc. moistened with appropriate organic solvent such as ethanol and acetone according to the dirt.

Such an organic solvent that it corrodes the test specimen or makes a protective film shall not be used.

7.4 Test conditions

The test environment shall be 65 % or under in the relative humidity at an ordinary temperature. The test conditions shall be as shown in table 2.

The test conditions for test specimen, standard specimen and reference specimen shall be the same.

Table 2 Test conditions

		Ordinary coatings ^{a)}	Hard coatings ^{b)}
Abrasive paper		CP 320	CP 240
Pressure	N	3.9 ± 0.1	19.6 ± 0.5
Rate of double stroke	ds/min	40 ± 2	
Number of preliminary double strokes ^{c)}	ds	50	100
Number of double strokes	ds	Appropriate number of double strokes ^{d)}	700 ^{e)}
Notes ^{a)} Coatings applied for the purpose other than wear resistance. ^{b)} Coatings applied for the purpose of wear resistance (see JIS H 8603). ^{c)} The preliminary abrasion may be omitted upon the agreement between the purchaser and the manufacturer in the case where the coating thickness is thin or the like. ^{d)} The number of abrasions shall be roughly 200 ds per 10 μm in coating thickness. ^{e)} The abrasion of 300 ds is permissible for coatings of about 25 μm, coatings by alloy containing 2 % or more copper or coatings by alloy containing 8 % or more silicon.			

7.5 Procedure

The procedure shall be as follows.

- a) Stick the abrasive paper on the outer circumferential face of abrasion wheel, and attach it to the test apparatus in 6.1. At this time, there shall be no gap and no overlap on both ends of abrasive paper.
- b) Align the test position of the standard specimen or the reference specimen using a guide ruler of the test apparatus.