International Standard

ISO 2106

Anodizing of aluminium and its alloys — Determination of mass per unit area (surface density) of anodic oxide coatings — Gravimetric method

Anodisation de l'aluminium et de ses alliages — Détermination de la masse par unité de surface (masse surfacique) des couches anodiques — Méthode gravimétrique

Second edition — 1982-11-15

Price based on 2 pages

ISO 2106-1982 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2106 was developed by Technical Committee ISO/TC 79, *Light metals and their alloys*.

This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2106-1976), which had been approved by the member bodies of the following countries :

Austria	Israel	Sweden
Belgium	Italy	Switzerland
Canada	Netherlands	Thailand
Egypt, Arab Rep. of	New Zealand	Turkey
Finland	Norway	United Kingdom
France	Poland	USA
Germany, F. R.	Portugal	USSR
Hungary	South Africa, Rep. of	
India	Spain	

The member body of the following country had expressed disapproval of the document on technical grounds :

Japan

Anodizing of aluminium and its alloys — Determination of mass per unit area (surface density) of anodic oxide coatings — Gravimetric method

1 Scope

This International Standard specifies a gravimetric method of determining the mass per unit area (surface density) of anodic oxide coatings on aluminium and its alloys.

2 Field of application

The method is applicable to all oxide coatings formed by anodizing aluminium and its alloys, either cast or wrought. This method is suitable for most aluminium alloys except those in which the copper content is greater than 6 %.

If the thickness is known with sufficient precision (see, for example, ISO 2128), determination of the mass per unit area (surface density) of the coating enables its apparent density to be calculated.

Inversely, if the conditions of application of the coating, and its density, are known, the determination of its mass per unit area (surface density) can permit an approximate calculation of its thickness to be made.

3 Reference

ISO 2128, *Anodizing of aluminium and its alloys — Determination of thickness of anodic oxide coatings — Non-destructive measurement by split-beam microscope.*

4 Principle

Dissolution of the anodic oxide coating on a weighed sample of known surface area, without significantly attacking the basis metal, using a mixture of phosphoric acid and chromium trioxide of specified concentration.

Reweighing of the sample after dissolution of the coating, and calculation of the mass lost. This mass is related to the unit area covered by the coating and is generally expressed in milligrams per square decimetre.

This is a destructive test.

5 Reagent

Phospho-chromic acid, prepared as follows :

— **phosphoric acid,** ϱ_{20} 1,7 g/ml : 35 ml;

— **crystallized chromium trioxide** : 20 g;

— **distilled water** : to make up to 1 l.

6 Apparatus

6.1 Laboratory balance, accurate to 0,1 mg.

6.2 Beakers.

6.3 Heating device.

7 Procedure

7.1 Preliminary treatment

The surface to be examined shall have an area of between 0,08 and 1 dm² and the mass of the sample shall not exceed 100 g. If the surface is dirty or impregnated with oil, grease or similar material, the foreign matter must be removed with the aid of a suitable organic solvent, such as trichlorethylene.

In certain cases, it is preferable to measure the mass of the oxide coating on one face only of the sample. In this case, the oxide coating on the other face is removed by a mechanical or chemical process, leaving the relevant face intact.

Alternatively, a protective agent, resistant to attack by the acidic test solution, may be applied over the reverse face of the sample.

7.2 Execution of the tests

After calculation of the anodized area, weigh the sample to the nearest 0,1 mg and immerse it in the phospho-chromic solution for 10 min at 100 °C. Then rinse it in distilled water, dry and reweigh. Repeat the immersion and weighing until no further loss in mass is observed.

NOTE — The freshly constituted reagent generally allows complete dissolution in 10 min. Its dissolving power diminishes with use : 1 l of solution is capable of dissolving about 12 g of aluminium oxide before the diminution is noticeable.

8 Expression of results

The mass per unit area (surface density) of the coating, ϱ_A, expressed in milligrams per square decimetre, is given by the equation

$$\varrho_A = \frac{m_1 - m_2}{A} \times 1\,000$$

where

m_1 is the mass, in grams, of the sample before dissolution of the coating;

m_2 is the mass, in grams, of the sample after dissolution of the coating;

A is the area, in square decimetres, effectively covered by the coating of which the mass is measured (without taking into account the edges or other parts not anodized).

9 Estimation of thickness

The average thickness of the coating, δ, in micrometres, can be estimated by means of the equation

$$\delta = \frac{\varrho_A}{\varrho \times 10}$$

where

ϱ_A is the mass per unit area (surface density), in milligrams per square decimetre, of the coating;

ϱ is the density, in grams per cubic centimetre, of the coating.

NOTE — The density of the coating depends on the alloy in question, the anodizing process and the seal. This density may vary, in normal processing conditions, between 2,3 and 3 g/cm³.

For thin oxide coatings produced under direct current in sulphuric solution, at a temperature of about 20 °C, on aluminium and alloys without copper, the density is assumed to be equal to 2,6 g/cm³ for sealed coatings and 2,4 g/cm³ for unsealed coatings.

The estimation of the thickness is more accurate for thin coatings (10 μm and less).

10 Test report

The test report shall include the following information :

a) the reference of the method used;

b) the results and the method of expression used;

c) any unusual features noticed during the determination;

d) any operations not included in this International Standard, or regarded as optional.