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Aluminium oxide used for the production of primary aluminium — Particle size analysis for the range 45 µm to 150 µm — Method using electroformed sieves

Oxyde d'aluminium utilisé pour la production d'aluminium primaire — Analyse granulométrique dans la gamme 45 µm à 150 µm — Méthode par emploi de tamis électroformés

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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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 226, *Materials for the production of primary aluminium*.

This third edition cancels and replaces the second edition (ISO 2926:2005), which has been technically revised to reflect modern industry practice. The major changes are:

— recommended effective aperture tolerance limits have been added;

— sieves are cleaned by brushing rather than using an ultrasonic bath;

— the mass of sample to be sieved is 50 g;

Introduction

This International Standard is based on AS 2879.6-1995 prepared by Standards Australia.

Aluminium oxide used for the production of primary aluminium — Particle size analysis for the range 45 µm to 150 µm — Method using electroformed sieves

1 Scope

This International Standard specifies a dry sieve method using electroformed sieves for determining the mass distribution of the particle sizes in aluminium oxide used for the production of primary aluminium.

This method is applicable to calcined aluminium oxide containing a maximum of 20 % mass fraction of particles having a mean diameter exceeding 150 µm, and containing a maximum of 15 % mass fraction of particles having a mean diameter less than 45 µm.

This method is not applicable to the use of woven wire sieves.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3310-3, *Test sieves — Technical requirements and testing — Part 3: Test sieves of electroformed sheets*

3 Principle

A test portion of the crude sample is sieved mechanically through electroformed sieves.

Each of the separate fractions is weighed on the sieve, and a cumulative mass of material retained on each sieve aperture size is calculated.

4 Apparatus

4.1 Test sieves, each including a sieving medium (screen) and a frame.

The frames shall be cylindrical, having nominal diameters of 200 mm and heights between 50 mm and 75 mm. A lid and a bottom receiver shall be included. The sieves, lid and bottom receiver shall be capable of being fitted together tightly to form a series of test sieves[1)] .

The screens shall be constructed of smooth electroformed sheet having square openings. The aperture tolerances shall be in accordance with ISO 3310-3.

The sieve apertures shall have nominal sizes of 150 µm, 106 µm, 75 µm, 53 µm and 45 µm. Refer to Annex B for effective aperture determination and tolerance limits.

1) Certified electroformed sieves manufactured by Precision Eforming of Cortland, New York, USA, are examples of suitable products available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.

4.2 Mechanical sieve shaker, capable of clamping the sieves mounted inside each other together with the top lid and bottom receiver to form a vertical assembly.

The apparatus[2)] shall impart to the sieve assembly a simultaneous horizontal rotary motion and a vertical tapping action resulting from the fall of a hammer. This combined action shall cause sufficient displacement of the aluminium oxide particles to prevent aggregation but not cause any deformation of the sieving screen or any size reduction of the aluminium oxide particles through shock or abrasion.

4.3 Laboratory top pan balance, capable of weighing the sieves to the nearest 0,01 g.

The balance may be fitted with a lightweight frame mounted on the weighing pan to enable direct weighing of test sieves and receiver.

4.4 Brush, fine bristled, soft, a few centimetres wide.

5 Procedure

5.1 Sample preparation

Split the sample into test portions by riffling or rotary sample division until the required mass is obtained.

Weigh the final split to the nearest 0,01 g. The mass (m_0) of the final split should fall in the range 45 to 55 g.

5.2 Preparation of test sieves

Prepare the test sieves as follows.

a) Clean each test sieve (4.1) in turn by inverting it over a suitable container, brushing the mesh to remove trapped particles and tapping the sieve frame lightly to remove any adhering particles.

b) Inspect each sieve to ensure that the mesh is not ruptured and there is not excessive aperture binding. Upon holding the sieve up to a light source, areas of blinding are visible as being darker in appearance. If more than 10 % of the sieve mesh is blinded the sieve is not sufficiently clean to use. Larger ruptures in the sieve may be seen by visual inspection. To see smaller ruptures magnification is required. Inspection using a stereo microscope is recommended; scan the entire mesh area and the edges to check for ruptures.

NOTE 1 Ruptures of the mesh can be successfully repaired using silver solder or hardening synthetic resin. When a repair is performed, check the repaired area under magnification to ensure the rupture is covered and that the solder is bonded to the mesh.

NOTE 2 Other options for cleaning sieves are given in Annex D.

5.3 Determination

Determine the size distribution as follows.

a) Weigh each sieve (masses m_1) on the top pan balance (4.3) to the nearest 0,01 g. Similarly, weigh the bottom receiver.

b) Assemble the test sieves (4.1) on the mechanical sieve shaker (4.2) in order of increasing aperture size from bottom to top, starting with the bottom receiver.

c) Spread the test portion (5.1) on the top-most sieve. Close with the tightly fitting lid and install the positioning cover. Lower the hammer onto the cover.

2) RO-TAP Testing sieve shakers, (W. S. Tyler Inc., Mentor, Ohio, U.S.A.), operated in accordance with the manufacturer's recommended settings, are examples of suitable products available commercially. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products.

d) Switch on the mechanical sieve shaker and allow it to operate for 30 min.

e) Remove the sieve stack, and weigh each sieve and its contents to the nearest 0,01 g (masses m_2).

f) Similarly weigh the bottom receiver and contents.

6 Calculation of results

Calculate the results as follows:

a) Calculate the masses of each retained sample from the following equation:

$$m_3 = m_2 - m_1 \quad (1)$$

where

m_3 is the mass of retained sample, in grams;

m_2 is the mass of test sieve plus retained sample, in grams;

m_1 is the mass of test sieve, in grams.

In the case of the sample collected in the bottom receiver, m_1 is the mass of the bottom receiver and m_2 is the mass of the bottom receiver plus contents.

b) Calculate the cumulative mass m_4 for each sieve size.

c) Calculate the mass recovered m_5, using the following equation:

$$m_5 = \sum m_3 \quad (2)$$

where m_3 is the mass of sieve contents for each sieve and the bottom receiver.

If the mass m_5 exceeds the mass of the original test portion (m_0) by more than 0,5 g, or if m_5 is less than m_0, then another test portion should be analysed. Due to absorption of moisture during the test, some increase in mass is normal. Any loss in mass is most likely caused by physical loss of sample.

d) Calculate, to two decimal places, the cumulative per cent final mass m_6 for each sieve aperture size, using the following equation:

$$m_6 = \frac{m_4}{m_5} \times 100$$

e) Prepare a table of values of m_6 corresponding to each successive nominal aperture size. Report each value of m_6 to one decimal place.

NOTE 1 It can be useful to plot a cumulative distribution curve of the mass passing through each sieve, expressed as a percentage, against the corresponding nominal aperture size, in order of decreasing aperture size.

NOTE 2 Annex A gives an example of a calculation (Table A.1) and reporting (Table A.2) of size analysis.

7 Test report

The test report shall include the following information:

a) the table of cumulative per cent mass retained for each nominal aperture size (m_6 values), expressed as per cent mass fraction of the original sample;

b) a reference to this International Standard, i.e. ISO 2926:2013;