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Aluminium oxide primarily used for production of aluminium — Method for calculating the Al_2O_3 content of smelter-grade alumina

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The UK participation in its preparation was entrusted to Technical Committee CII/24, Raw materials for the aluminium industry.

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

ISO 12315

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Aluminium oxide primarily used for production of aluminium — Method for calculating the Al_2O_3 content of smelter-grade alumina

Oxyde d'aluminium principalement utilisé pour la production d'aluminium — Méthode de calcul de la teneur en Al_2O_3 de l'alumine pour électrolyse

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ISO 12315 was prepared by Technical Committee ISO/TC 226, *Materials for the production of primary aluminium*.

This International Standard is based on AS 2879.11, *Alumina — Guide to reporting Al_2O_3 content of smelter-grade alumina*, prepared by the Standards Australia Committee MN/9, *Alumina and Materials Used in Aluminium Production*.

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INTERNATIONAL STANDARD ISO 12315:2010(E)

Aluminium oxide primarily used for production of aluminium — Method for calculating the Al_2O_3 content of smelter-grade alumina

1 Scope

This International Standard describes methods for calculating and reporting the Al_2O_3 content of smelter-grade alumina, on either a dry or ignited basis, from the results of the determinations in accordance with ISO 806 and AS 2879.7.

NOTE Typical values of a smelter-grade alumina, if reported on a dry basis, would be in the range of 98,5 % to 98,9 % and, if reported on an ignited basis, would be in the range of 99,4 % to 99,7 % mass fraction.

2 Normative references

The following referenced documents are indispensable for the application 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 806, *Aluminium oxide primarily used for the production of aluminium — Determination of loss of mass at 300 °C and 1 000 °C*

AS 2879.7, *Alumina — Determination of trace elements — Wavelength dispersive X-ray fluorescence spectrometric method*[1)]

3 Principle

From the determination of trace elements in accordance with AS 2879.7, where the elements are determined on an undried ("as-received" basis) by X-ray fluorescence spectrometry analysis, and the loss of mass at 300 °C and 1 000 °C is determined in accordance with ISO 806, the proportion by mass is calculated and expressed as a percentage.

The Al_2O_3 content of alumina, expressed as a percentage (mass fraction), is calculated by subtracting the percentage of trace elements from the total, expressed as 100 %. The Al_2O_3 content of alumina can be expressed on a dried basis or an ignited basis.

The dried basis method eliminates the effect of loss of mass after heating to 300 °C, under defined conditions. The ignited basis method eliminates the loss of mass after heating to 1 000 °C, under defined conditions.

Sulfur (S) shall be determined and included as its oxide, SO_2, in the sum of impurities term, ΣI, if the alumina is derived from heavy-fuel-oil calcination. Sulfur from this source is largely present as adsorbed SO_2. There is no standard method for determining sulfur in alumina.

1) To be replaced by ISO 23201, *Aluminium oxide primarily used for production of aluminium — Determination of trace elements — Wavelength dispersive X-ray fluorescence spectrometric method* (under preparation).

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NOTE 1 By industry convention, these mass losses are often referred to as “moisture on ignition (MOI)” and “loss on ignition (LOI)”, respectively.

NOTE 2 When sulfur is determined, it is traditionally reported as SO_3, not SO_2.

4 Procedures

The determinations shall be as follows.

a) Determine the impurities according to AS 2879.7.

b) Determine the loss of mass at 300 °C (moisture content, MOI) and loss of mass on ignition at 1 000 °C (LOI) (on a dry or “as-received” basis) in accordance with ISO 806.

c) Determine the sulfur, reported as SO_3, if the alumina is derived from heavy-fuel-oil calcination.

5 Calculations and expression of results

Calculate and express the results as follows:

a) Al_2O_3 content determined on an ignited at 1 000 °C basis:

1) for loss on ignition of alumina determined on a dried at 300 °C basis, the Al_2O_3 content, expressed as a percentage, is calculated using Equation (1).

$$w_{Al_2O_3,1000,d} = 100 - \frac{100}{100 - w_{300} - w_{\Delta 1000,d} + \frac{w_{\Delta 1000,d} \times w_{300}}{100}} \times (\Sigma I) \quad (1)$$

where

$w_{Al_2O_3,\,1\,000,d}$ is the Al_2O_3 content determined on an ignited at 1 000 °C basis, expressed as a percentage;

w_{300} is the loss of mass at 300 °C, expressed as a percentage;

$w_{\Delta 1\,000,d}$ is the loss of mass on ignition (300 °C to 1 000 °C), expressed on a dried at 300 °C basis;

ΣI is the sum of trace elements determined in accordance with AS 2879.7. SO_3 shall be included in this sum, if required.

2) for loss on ignition of alumina determined on an “as-received” basis calculate the Al_2O_3 content, expressed as a percentage, using Equation (2).

$$w_{Al_2O_3,1000,ar} = 100 - \frac{100}{\left(100 - w_{300} - w_{\Delta 1000,ar}\right)} \times (\Sigma I) \quad (2)$$

where

$w_{Al_2O_3,\,1\,000,ar}$ is the Al_2O_3 content determined on an ignited at 1 000 °C basis, expressed as a percentage;

w_{300} is the loss of mass at 300 °C, expressed as a percentage;

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$w_{\Delta 1\,000,ar}$ is the loss of mass on ignition (300 °C to 1 000 °C) expressed on an "as-received" basis;

ΣI is the sum of the trace-element oxides determined in accordance with AS 2879.7. SO_3 shall be included in this sum, if required.

b) Al_2O_3 content determined on a dried at 300 °C basis:

1) for loss on ignition of alumina determined on a dried at 300 °C basis, the Al_2O_3 content, expressed as a percentage, is calculated using Equation (3).

$$w_{Al_2O_3,\,300,d} = 100 - w_{\Delta 1000,d} - \frac{100}{(100 - w_{300})} \times \Sigma I \quad (3)$$

where

$w_{Al_2O_3,\,300,d}$ is the Al_2O_3 content determined on a dried at 300 °C basis, expressed as a percentage,

w_{300} is the loss of mass at 300 °C, expressed as a percentage;

$w_{\Delta 1\,000,d}$ is the loss of mass on ignition (300 °C to 1 000 °C) on a dried basis;

ΣI is the sum of the trace-element oxides determined in accordance with AS 2879.7. SO_3 shall be included in this sum, if required.

2) for loss on ignition of alumina determined on an "as-received" basis calculate the Al_2O_3 content, expressed as a percentage, is calculated using Equation (4).

$$w_{Al_2O_3,\,300,ar} = 100 - \frac{100}{(100 - w_{300})} \times \left(w_{\Delta 1000,ar} + \Sigma I\right) \quad (4)$$

where

$w_{Al_2O_3,\,300,ar}$ is the Al_2O_3 content determined on a dried at 300 °C basis, expressed as a percentage;

w_{300} is the loss of mass at 300 °C, expressed as a percentage;

$w_{\Delta 1\,000,ar}$ is the loss of mass on ignition (300 °C to 1 000 °C), expressed on an "as-received" basis;

ΣI is the sum of the trace-element oxides determined in accordance with AS 2879.7. SO_3 shall be included in this sum, if required.

6 Test report

The test report should include the following information:

a) a reference to this International Standard;

b) the date on which the sample was taken;

c) the date of the determinations and calculations;

d) details necessary for the complete identification of the material tested;

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e) whether the Al_2O_3 content was determined and calculated on a dried at 300 °C or ignited at 1 000 °C basis;

f) the Al_2O_3 content, recorded to the nearest first decimal place.

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