INTERNATIONAL STANDARD

ISO 15379-2

Second edition
2015-05-15

Carbonaceous materials for the production of aluminium — Cathode block materials —

Part 2: Determination of the expansion due to sodium penetration without application of pressure

Produits carbonés utilisés pour la production de l'aluminium — Blocs cathodiques —

Partie 2: Détermination de l'expansion due à la pénétration du sodium sans application de pression

Reference number
ISO 15379-2:2015(E)

© ISO 2015



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Principle **1**
4 Apparatus **1**
5 Reagents **2**
6 Sampling **2**
7 Procedure **3**
8 Results **3**
8.1 Calculation 3
8.2 Precision 3
9 Test report **4**

© ISO 2015 – All rights reserved

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 document 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 second edition cancels and replaces the first edition (ISO 15379-2:2004), which has been technically revised.

ISO 15379 consists of the following parts, under the general title *Carbonaceous materials for the production of aluminium — Cathode block materials:*

— *Part 1: Determination of the expansion due to sodium penetration with application of pressure*

— *Part 2: Determination of the expansion due to sodium penetration without application of pressure*

© ISO 2015 – All rights reserved

Introduction

Expansion due to sodium penetration is an important property of carbon cathode blocks. As soon as alumina electrolysis starts, sodium penetrates into the carbon cathode blocks causing swelling of these blocks. This increase in volume creates mechanical stresses within the blocks and/or bulging of the bottom block plate. This can lead to cracks through which liquid aluminium and/or liquid electrolyte can flow, reaching the thermal insulation beneath the blocks and destroying these ceramic materials. In such a case, the electrolysis cell has to be relined, resulting in loss of aluminium production and high expenses. Therefore, cathode blocks produced with materials allowing only low sodium penetration and having the lowest possible expansion due to sodium penetration are preferred.

The study can be supplemented by measuring electrical resistivity (see ISO 11713) before and after the test.

© ISO 2015 – All rights reserved

Carbonaceous materials for the production of aluminium — Cathode block materials —

Part 2: Determination of the expansion due to sodium penetration without application of pressure

1 Scope

This part of ISO 15379 specifies a method that covers the determination of linear expansion under external pressure due to sodium penetration in cathode-block materials used in the production of aluminium.

The linear expansion of the blocks depends on the sampling direction due to anisotropy.

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 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 8007-1, *Carbonaceous materials used in the production of aluminium — Sampling plans and sampling from individual units — Part 1: Cathode blocks*

ASTM E 220, *Standard Test Method for Calibration of Thermocouples By Comparison Techniques*

3 Principle

An anodic graphite crucible containing a cryolitic bath with an initial cryolite ratio of 4,0 and with a cathode carbon sample suspended in the bath, as shown in Figure 1, is used for this experiment. The whole assembly is heated to (980 ± 5) °C and is then electrolyzed for 2 h with a current density of approximately 0,7 A/cm^2 (see Clause 7). The expansion is measured by a probe, which is inserted into a hole that is drilled into the sample.

4 Apparatus

The principle of the apparatus for measuring sodium expansion is shown in Figure 1.

4.1 Furnace, capable of maintaining a temperature of 980 °C, with a temperature gradient over the melt of less than 10 °C.

4.2 Furnace control device, suitable for holding the temperature at (980 ± 5) °C.

4.3 Temperature-measuring device, i.e. a thermocouple, preferably type K or S, capable of determining the temperature to ± 5 °C at 980 °C.

The thermocouple should be calibrated in accordance with ASTM E 220.

© ISO 2015 – All rights reserved