INTERNATIONAL STANDARD

ISO 14428

Second edition
2019-11

Carbonaceous materials for the production of aluminium — Cold and tepid ramming pastes — Expansion/shrinkage during baking

Produits carbonés utilisés pour la production de l'aluminium — Pâtes de brasquage froides et tièdes — Expansion/rétrécissement durant la cuisson

Reference number
ISO 14428:2019(E)

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

Published in Switzerland

Contents

Page

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 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO 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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 14428:2005), which has been technically revised.

The main changes to the previous edition are as follows:

— Clause 8: new calculation concept based on average expansion/shrinkage within newly defined temperature ranges

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The expansion/shrinkage of ramming pastes used in the production of aluminium is an important property, because excessive shrinkage can cause cracks in the baked paste serving as a lining material in alumina electrolysis cells. These cracks can cause leakage of the liquid bath, destroying the sidewall lining and the steel shell and thus leading to shutdown of the cell. Ramming pastes change phase from plastic to non-plastic between 400 °C and 600 °C (200 °C and 300 °C for resin binders). The shrinkage which occurs between the temperature at which the paste becomes non-plastic and the operating temperature (950 °C) is an important factor. Apparent shrinkage in the viscous range is due to slumping rather than actual shrinkage.

Carbonaceous materials for the production of aluminium — Cold and tepid ramming pastes — Expansion/shrinkage during baking

1 Scope

This document specifies the determination of expansion/shrinkage during baking of cold and tepid ramming pastes used in the production of aluminium.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14422, *Carbonaceous materials used in the production of aluminium — Cold-ramming pastes — Methods of sampling*

ISO 14427, *Carbonaceous materials used in the production of aluminium — Cold and tepid ramming pastes — Preparation of unbaked test specimens and determination of apparent density after compaction*

ISO 17034, *General requirements for the competence of reference material producers*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

The change in height of a rammed sample of paste is measured at temperatures increasing to 950 °C, with a holding period of 3 h at the highest temperature. The shrinkage of the paste between the temperature at which the paste has become non-plastic and at 950 °C (both before and after the holding period) is determined.

5 Apparatus and materials

5.1 **Device** for measuring the sample length, accurate to ± 0,1 mm.

5.2 **Push-rod dilatometer**, capable of determining changes in length of the specimen of $2 \times 10^{-5}\ l_0$ (i.e. 1 µm for 50 mm length).

The contact force of the extensometer shall not exceed 2 N. The expansion/shrinkage shall be measured vertically. An example of a vertical dilatometer is given in Figure 1. The dilatometer should preferably consist of a push rod and an outer tube made of the same material. Vitreous silica is recommended as the material for the push rod and the outer tube. The gap between the outer tube and the sample shall