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Corrosion of metals and alloys — Test method for high temperature corrosion testing of metallic materials by embedding in salt, ash, or other solids

Corrosion des métaux et alliages — Méthode d'essai pour essais de corrosion à haute température de matériaux métalliques par enfouissement dans du sel, des cendres ou d'autres solides

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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).

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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 156, *Corrosion of metals and alloys*.

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Introduction

In contrast to high temperature corrosion occurring in a gaseous environment, which is covered in ISO 21608 and ISO 13573, this International Standard focuses on high temperature corrosion occurring on materials that are in direct contact with solid corrosive substances, commonly referred to as under-deposit corrosion.

This International Standard considers the case of a metallic material embedded, partially or completely, in a corrosive powder that is present in abundance and remains completely or partially in the solid state throughout high temperature exposure. Partially embedded test pieces offer the advantage of allowing investigation of corrosion at three different positions, i.e. under the powder, at the powder/gas phase interface, and in the gas phase above the corrosive powder.

The closely-related condition involving immersion in a molten salt or other liquid is described in ISO 17245, and that involving application of a surface deposit of salt, ash, or other substances in ISO 17224.

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Corrosion of metals and alloys — Test method for high temperature corrosion testing of metallic materials by embedding in salt, ash, or other solids

1 Scope

This International Standard specifies the method for high temperature corrosion testing of metallic materials by embedding in a corrosive powder made up of salt, ash, and/or other solids and exposing them to high temperature in a controlled gas environment to evaluate their corrosion resistance.

Two options exist: fully embedding and partially embedding.

Fully embedding is used in cases in which a mass change measurement is required.

Partially embedding is used to investigate three potentially different interaction zones on a single test piece, i.e. the embedded part, the non-embedded part, and the gas/powder interface region. Therefore, gravimetric measurements are not appropriate and metallographic investigations are necessary instead.

This International Standard does not cover methods where test pieces are immersed in a liquid or cases in which a surface deposit is applied to the test pieces. These methods are covered in ISO 17245 and ISO 17224, respectively.

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 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment: Micrometers for external measurements — Design and metrological characteristics*

ISO 6906, *Vernier callipers reading to 0,02 mm*

ISO 8044, *Corrosion of metals and alloys — Basic terms and definitions*

ISO 8407:2009, *Corrosion of metals and alloys — Removal of corrosion products from corrosion test specimens*

ISO 21608:2012, *Corrosion of metals and alloys — Test method for isothermal-exposure oxidation testing under high-temperature corrosion conditions for metallic materials*

ISO 26146, *Corrosion of metals and alloys — Method for metallographic examination of samples after exposure to high-temperature corrosive environments*

ASTM E3, *Standard guide for preparation of metallographic specimens*

ASTM E220, *Standard method for calibration of thermocouples by comparison techniques*

ASTM E230, *Standard temperature-electromotive forces tables for standardized thermocouples*

ASTM E407, *Standard practice for microetching metals and alloys*

ASTM E1350, *Standard test method for testing sheathed thermocouples prior to, during and after installation*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8044 and the following apply.

3.1
affected layer
layer beneath the test piece surface that is affected in its composition and/or structure due to corrosion

3.2
corrosive powder
powder mixture made up of salt, ash, and/or other solids that contains compounds that are expected to react with the metal at high temperature

3.3
controlled gas environment
flowing gas mixture of defined composition and flow rate which can affect the behaviour of the corrosive powder

3.4
descaling
removal of corrosion products and corrosive phases from the test piece surface before measurement of the mass of the remaining metal

4 Test method

4.1 Principle

Mass change measurements can be performed with fully embedded test pieces. In this case, the test shall be performed with at least three test pieces of each material to ensure reproducibility of the test results. Two test pieces shall be used for determination of mass change or dimensional change, and one shall be used for observation of the surface and/or cross section.

4.2 Reagents and materials

4.2.1 Test pieces

Test pieces for fully embedding shall have the form of a rectangular plate, a disc, or a cylinder with a minimum surface area of 300 mm^2 and a minimum thickness of 1,5 mm.

Test pieces for partially embedding shall have the form of a rectangular plate with a minimum length of 60 mm and a minimum thickness of 1,5 mm. The rectangular geometry allows accurate metallographic examinations of longitudinal sections as well as transverse sections, which is not possible with a cylindrical test piece.

If the test pieces cannot be made according to these specifications, the shape and dimensions of the test pieces shall be in accordance with the agreement between the parties involved.

The test pieces shall be machined to remove the strata affected by cutting.

The final finishing of the surface of the test pieces shall be performed with abrasives with a mean particle diameter of approximately 15 µm. This can be achieved by the use of abrasives according to Table 1.

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