BS ISO 11258:2015

BSI Standards Publication

Iron ores for shaft direct-reduction feedstocks — Determination of the reducibility index, final degree of reduction and degree of metallization

bsi.

...making excellence a habit.™

Document Sharing Hub

National foreword

This British Standard is the UK implementation of ISO 11258:2015. It supersedes BS ISO 11258:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/58, Iron ores.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 79293 9

ICS 73.060.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

Amendments issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS ISO 11258:2015

INTERNATIONAL STANDARD

ISO 11258

Third edition
2015-08-15

Iron ores for shaft direct-reduction feedstocks — Determination of the reducibility index, final degree of reduction and degree of metallization

Minerais de fer pour charges utilisées dans les procédés par réduction directe — Détermination de l'indice de réductibilité, du degré final de réduction et du degré de métallisation

Reference number
ISO 11258:2015(E)

Documents
Document Sharing Hub

© ISO 2015

Full document details: BS ISO 11258:2015

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

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub

Full document details: BS ISO 11258:2015

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **1**
5 Sampling, sample preparation, and preparation of test portions ... **2**
5.1 Sampling and sample preparation ... 2
5.2 Preparation of test portions ... 2
6 Apparatus ... **2**
6.1 General ... 2
7 Test conditions ... **3**
7.1 General ... 3
7.2 Reducing gas ... 3
7.2.1 Composition ... 3
7.2.2 Purity ... 3
7.2.3 Flow rate ... 3
7.3 Heating and cooling gas ... 3
7.4 Temperature of the test portion ... 4
8 Procedure ... **4**
8.1 Number of determinations for the test ... 4
8.2 Chemical analysis ... 4
8.3 Reduction ... 4
8.4 Chemical analysis after reduction ... 4
9 Expression of results ... **5**
9.1 Calculation of the final degree of reduction ($\boldsymbol{R}_{90}$) ... 5
9.2 Calculation of the reducibility indices $dR/dt(R{=}40)$ and $dR/dt(R{=}90)$ ... 5
9.2.1 Reduction curve ... 5
9.2.2 Reducibility index for 40 % reduction ... 5
9.2.3 Reducibility index for 90 % reduction ... 6
9.3 Calculation of the degree of metallization (***M***) ... 6
9.3.1 Determination of the degree of metallization from chemical analysis (***M***) ... 6
9.3.2 Determination of the degree of metallization from $\boldsymbol{R}_{90}$ ***(MR)*** ... ***6***
9.4 Repeatability for $\boldsymbol{R}_{90}$ and acceptance of test results ... 7
10 Test report ... **7**
11 Verification ... **7**
Annex A (normative) **Flowsheet of the procedure for the acceptance of test results** ... **11**
Annex B (informative) **Derivation of formula for reducibility** ... **12**
Annex C (informative) **Derivation of formula for degree of metallization from $\boldsymbol{R}_{90}$** ... **14**
Bibliography ... **16**

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 11258:2015

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 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 102, *Iron ore and direct reduced iron*, Subcommittee SC 3, *Physical testing*.

This third edition cancels and replaces the second edition (ISO 11258:2007), of which it constitutes a minor revision to contemplate the outcomes of the studies on mass definition, as well as minor editorial improvements.

© ISO 2015 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 11258:2015

Introduction

This International Standard concerns one of a number of physical test methods that have been developed to measure various physical parameters and to evaluate the behaviour of iron ores, including reducibility, disintegration, crushing strength, apparent density, etc. This method was developed to provide a uniform procedure, validated by collaborative testing, to facilitate comparisons of tests made in different laboratories.

The results of this test have to be considered in conjunction with other tests used to evaluate the quality of iron ores as feedstocks for direct reduction processes.

This International Standard can be used to provide test results as part of a production quality control system, as a basis of a contract, or as part of a research project.

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 11258:2015

Documents
Document Sharing Hub

Full document details: BS ISO 11258:2015

INTERNATIONAL STANDARD ISO 11258:2015(E)

Iron ores for shaft direct-reduction feedstocks — Determination of the reducibility index, final degree of reduction and degree of metallization

CAUTION — This International Standard can involve hazardous operations and equipment. This International Standard does not purport to address all of the safety issues associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.

1 Scope

This International Standard specifies a method to provide a relative measure for evaluating the extent to and ease to which oxygen can be removed from iron ores, when reduced under conditions resembling those prevailing in shaft direct-reduction processes. It specifies the determination of the reducibility, final degree of reduction, and degree of metallization.

This International Standard is applicable to lump ores and hot-bonded pellets.

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 2597-1, *Iron ores — Determination of total iron content — Part 1: Titrimetric method after tin(II) chloride reduction*

ISO 2597-2, *Iron ores — Determination of total iron content — Part 2: Titrimetric methods after titanium(III) chloride reduction*

ISO 3082, *Iron ores — Sampling and sample preparation procedures*

ISO 5416, *Direct reduced iron — Determination of metallic iron — Bromine-methanol titrimetric method*

ISO 9035, *Iron ores — Determination of acid-soluble iron(II) content — Titrimetric method*

ISO 11323, *Iron ore and direct reduced iron — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11323 apply.

4 Principle

The test portion is isothermally reduced in a fixed bed, at 800 °C, using a reducing gas consisting of H_2, CO, CO_2, and N_2, and is weighed continuously or at specified time intervals until 90 min of reduction is reached. The rate of reduction is calculated at the oxygen/iron ratio of 0,9 and the final degree of reduction is calculated from the oxygen mass loss after 90 min (R_{90}). The degree of metallization is calculated either by a formula based on R_{90} or by chemical analysis of the reduced product.

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 11258:2015