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Iron ores for blast furnace feedstocks — Determination of the decrepitation index

Minerais de fer pour charges de hauts fourneaux — Détermination de l'indice de décrépitation

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Foreword

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This document was prepared by Technical Committee ISO/TC 102, *Iron ore and direct reduced iron*, Subcommittee SC 3, *Physical testing*.

This fourth edition cancels and replaces the third edition (ISO 8371:2015), which has been technically revised.

The main changes are as follows:

— test conditions such as test sample drying time, type of sieves, heating rate of the test portion, and the accuracy of the weighting device have been cleared out.

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.

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Introduction

This document concerns one of a number of physical test methods that have been developed to measure various physical parameters and characteristics 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 need to be considered in conjunction with other tests used to evaluate the quality of iron ores as feedstocks for blast furnace processes.

This document 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.

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Iron ores for blast furnace feedstocks — Determination of the decrepitation index

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

1 Scope

This document specifies a method to provide a relative measure for evaluating the degree of size degradation caused by rapid heating of iron ores. It specifies the determination of the decrepitation index.

This document is applicable to lump ores for blast furnace feedstocks.

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

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

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.

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

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

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

4 Principle

The test portion is introduced into a hot furnace, rapidly heated from room temperature to 700 °C (measured with a thermocouple at the centre of test portion) in a time interval close to 30 min, then withdrawn from the hot furnace, and finally cooled in air down to room temperature. It is sieved with a test sieve having square openings of 6,3 mm. The decrepitation index is calculated as the mass percentage of material of size −6,3 mm.

5 Sampling, sample preparation and preparation of test portions

5.1 Sampling and sample preparation

Sampling of a lot and preparation of a test sample shall be in accordance with ISO 3082.

The size range for lump ores shall be −25,0 mm +20,0 mm.

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A test sample of at least 5,0 kg, on a dry basis, of the sized lump ores shall be obtained.

Oven-dry the test sample at 105 °C ± 5 °C for 24 h and cool it to room temperature. Screen the pre-dried sample again on a 20,0 mm sieve to remove any adhering fines. It is recommended the test sample be tested or kept in a desiccator immediately after being dried to avoid potential absorption of moisture by the test sample.

5.2 Preparation of test portions

Only particles taken at random shall be used to constitute a test portion.

At least ten test portions, each of approximately 500 g (± the mass of one particle) shall be prepared from the test sample.

Weigh the test portions to the nearest 0,1 g and register the mass of each test portion (m_0) on its recipient label.

6 Apparatus

6.1 General

The test apparatus shall comprise:

a) ordinary laboratory equipment, such as an oven, hand tools, time-control device and safety equipment;

b) a furnace;

c) a test-portion holder;

d) test sieves;

e) a weighing device.

6.2 Furnace, having a heating capacity and temperature control able to heat the test portion from room temperature to 700 °C in 30 min.

6.3 Test portion holder, made of non-scaling, heat-resistant metal to withstand temperatures higher than 700 °C, equipped with a thermocouple to measure the temperature at the centre of the test portion. The cover shall be loosely fitted with the holder for the release of volatiles from the test portion when heated.

6.4 Test sieves, in accordance with ISO 3310-1 of metal wire cloth and having nominal square apertures of 6,30 and 10 (optional) mm.

6.5 Weighing device, capable of weighing the test sample and test portions to an accuracy of 0,1 g.

7 Procedure

7.1 Number of determinations for the test

Owing to the heterogeneity of lump ores, carry out the test ten times on each test sample.

7.2 Heating

WARNING — This test involves handling of hot apparatus and test portions. In addition, for some iron ores, spitting can occur when loading the test portion into the hot furnace. Suitable hand and eye protection shall be used by the operator.

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Set the empty furnace at a pre-determined temperature, turn on the furnace and begin heating. When the furnace reaches the pre-determined temperature, keep it constant for a further 20 min.

Place the test portion into the sample holder, cover the sample holder and put the set in the furnace. Start the timer immediately after the test portion is introduced in the furnace.

The temperature at the centre of the test portion shall be monitored during the test and shall reach (700 ± 10) °C within 30 ± 3 min. At the end of the test, remove the holder and test portion from the furnace and allow the test portion to cool to below 50 °C.

7.3 Sieving

Discharge the test portion carefully from the sample holder, determine and record its mass (m_1). Hand sieve with care on a test sieve with a nominal square opening of 6,30 mm (see 6.4). Determine and record the mass retained on 6,30 mm (m_2) and pan (m_3) to one decimal place. A 10 mm square opening sieve can be used together with the 6,30 mm sieve to help with sieving efficiency. The mass on the pan is recorded to monitor the mass loss during the sieving operation.

NOTE Equivalent mechanical sieving can be used, provided that preliminary test programme is carried out according to ISO 3086, the hand sieving being the reference method.

Sieving results are influenced by the sieve shaker characteristics. Therefore, in cases where two or more laboratories need to compare their results for commercial or research purposes, the sieving conditions should be adjusted until identical results are obtained for the same test sample.

8 Expression of results

The decrepitation index, $DI_{-6,3}$, expressed as a percentage by mass, is calculated from Formula (1):

$$DI_{-6,3} = \frac{m_1 - m_2}{m_1} \times 100\,\% \qquad (1)$$

where

m_1 is the mass, in grams, of the test portion after thermal treatment;

m_2 is the mass, in grams, of the fractions retained on the 6,30 mm and 10 mm (if used) sieves.

Express the result to one decimal place.

9 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 8371:2024;

b) all details necessary for the identification of the test sample;

c) the name and address of the test laboratory;

d) the date of the test;

e) the date of the test report;

f) the signature of the person responsible for the test;

g) the details of any operation and test conditions not specified in this document or regarded as optional, as well as any incident which can influence on the test results;

h) the decrepitation index, $DI_{-6,3}$, of each individual test;

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