International Standard

ISO 540

Hard coal — Determination of ash fusibility

Houille — Détermination de la fusibilité des cendres

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

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Foreword

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This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 5, *Methods of analysis*.

This fifth edition cancels and replaces the fourth edition (ISO 540:2008), which has been technically revised.

The main changes are as follows:

— change of the document title;

— removal of coke from scope;

— increase of the allowance of the pyramid to between 12 mm and 19 mm.

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

The method for determination of the fusibility temperatures of coal ash described in this document provides information about the fusion and melting behaviour of the composite inorganic constituents of the ash at high temperatures. The standard method is based on the “Seger Cone” method, which is well known in the ceramic industry, the use of which predates the year 1900. The conditions of the test, as well as basic studies on the influence of ash chemistry and of gas composition on ash fusibility temperatures (which have led to the standardization of the method), arose from the pioneering work of Fieldner, Hall and Field [1].

In the laboratory, the ash used for the test is a homogeneous mixture prepared from a representative sample of the coal, and the determination is performed at a controlled rate of heating in either a reducing or an oxidizing atmosphere. In contrast, under industrial conditions, the complex processes of combustion and fusion involve heterogeneous mixtures of particles, heating rates (that can be several orders of magnitude greater than those used in the standard test) and variable gas composition.

During the first quarter of the 20th century, laboratory, pilot-scale and field studies were undertaken to establish that the ash fusibility test can provide a reasonable indication of the propensity of ash to form fused deposits (referred to as “clinker”) in stoker and other fuel-bed type furnaces.[2] Subsequently, the test has been used as a general indicator of the tendency for ash to fuse on heating and of ash slagging propensity in pulverized coal-fired furnaces.

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Hard coal — Determination of ash fusibility

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1 Scope

This document specifies a method of determining the characteristic fusion temperatures of ash from hard coal.

NOTE Descriptors: fossil fuels, ash, ashes, tests, high temperature tests, determination, and fusibility.

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 1171, *Coal and coke — Determination of ash*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1
deformation temperature
DT
temperature at which the first signs of rounding, due to melting, of the tip or edges of the test piece occur

Note 1 to entry: Shrinkage or distortion of the test piece, or rounding of cracks and fins, are not criteria for deformation temperature and should be ignored if the tip and edges remain sharp. However, for some hard coals, the temperature at which the test piece shrinkage begins can be of interest and should be reported as a feature noted during the determination.

3.2
sphere temperature
ST
temperature, in the case of pyramidal and truncated-cone test pieces, at which the height is equal to the width of the base, and temperature, in the case of cubical or cylindrical test pieces, at which the edges of the test pieces become completely round with the height remaining unchanged

3.3
hemisphere temperature
HT
temperature at which the test piece forms approximately a hemisphere, i.e. when the height becomes equal to half the base diameter

3.4
flow temperature
FT
temperature at which the ash melt is spread out over the supporting tile in a layer, the height of which is one-third of the height of the test piece at the hemisphere temperature

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