FINAL DRAFT International Standard

ISO/FDIS 10329

Hard coal — Determination of plastic properties — Constant-torque Gieseler plastometer method

ISO/TC **27**/SC **5**

Secretariat: **SA**

Voting begins on:
2025-02-05

Voting terminates on:
2025-04-02

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Reference number
ISO/FDIS 10329:2025(en)

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Published in Switzerland

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Foreword

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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 document 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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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 27, *Coal and coke*, Subcommittee SC 5, *Methods of analysis*.

This third edition cancels and replaces the second edition (ISO 10329:2017), which has been technically revised.

The main changes are as follows:

— updated the scope of this document, it is only applicable to hard coal;

— clarified reporting requirements for the various ranges of dd/min;

— editorial revisions.

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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Hard coal — Determination of plastic properties — Constant-torque Gieseler plastometer method

1 Scope

This document specifies a method for obtaining a relative measure of the plastic behaviour of hard coal when heated under prescribed conditions. The method is used to obtain values of the plastic properties of coals and blends used in carbonization and in other situations where determination of plastic behaviour of coals is of practical importance.

NOTE The empirical nature of this test requires proper equipment calibration to produce fluidity readings which are a true indication of the relative plastic behaviour of the coal.

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 18283, *Coal and coke — Manual sampling*

ISO 13909-1, *Hard coal and coke — Mechanical sampling — Part 1: General introduction*

ISO 13909-2, *Hard coal and coke — Mechanical sampling — Part 2: Coal — Sampling from moving streams*

ISO 13909-3, *Hard coal and coke — Mechanical sampling — Part 3: Coal — Sampling from stationary lots*

ISO 13909-4:2016, *Hard coal and coke — Mechanical sampling — Part 4: Coal — Preparation of test samples*

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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
dial division per minute
dd/min
measure of stirrer rotation rate, as used in the constant-torque Gieseler plastometer method

Note 1 to entry: There are 100 dial divisions for each full 360° rotation of the stirrer. The fluidity result is expressed as total dial divisions turned by the stirrer in a 1 min time period, i.e. dd/min.

3.2
initial softening temperature
temperature at which dial movement or electronic readout indicates a stirring shaft movement of one *dial division per minute* (3.1), with continued indication of movement of at least 1 dd/min thereafter

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3.3
maximum fluidity temperature
temperature at which stirring shaft rotation reaches the maximum rate

3.4
plastic range
difference between the initial softening temperature and the solidification temperature

3.5
final fluidity temperature
temperature at which the last 1 dd/min stirrer rotation rate is reached

3.6
solidification temperature
temperature at which the stirring shaft stops

3.7
maximum fluidity
maximum rate of rotation for the stirring shaft in *dial divisions per minute* (3.1)

3.8
jamming
swelling up of coal into the retort tube during the test

Note 1 to entry: Jamming can produce a lower fluidity result than expected and can only be noted after visual inspection of the disassembled crucible and retort at the conclusion of the test.

3.9
breaking
free spinning behaviour of coal, either by rotating at maximum motor speed or by abrupt changes in rotation

Note 1 to entry: Breaking occurs as a result of a molten ball of coal forming around the base of the stirrer, and makes reporting of the true *maximum fluidity* (3.7) of the coal difficult.

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4 Principle

Measurements of the plastic properties of coals are made by applying a constant torque to a stirrer placed in a crucible into which the coal is charged. The crucible is immersed in a bath and the temperature increased uniformly. The rotation of the stirrer is recorded in relation to increase in temperature.

5 Apparatus

5.1 Gieseler plastometer retort, composed of the following component parts (see Figure 1).

5.1.1 Retort crucible, cylindrical, with (21,4 ± 0,1) mm inside diameter, and (35,0 ± 0,3) mm in depth with exterior threads for joining the crucible to the barrel.

The crucible shall have a (2,38 ± 0,02) mm diameter notch with an included angle of 70° in the centre of its inside base to serve as a seat for the stirrer.

5.1.2 Retort crucible cover, with interior threads for joining the crucible cover to the crucible and exterior threads for joining the crucible cover to the barrel.

The inside diameter of the hole which accommodates the stirrer shall be (9,5 ± 0,1) mm.

5.1.3 Guide sleeve, provided near the upper end of the stirrer to guide the latter within the barrel with a clearance of between 0,05 mm and 0,10 mm.

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