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Title: Draft BS ISO 24835-1 Natural gas upstream area - Determination and calculation of shale brittleness index. Part 1: Determination of shale mineral characteristics based on X-Ray diffraction method.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 24835-1

Natural gas upstream area — Determination and calculation of shale brittleness index —

Part 1: Determination of shale mineral characteristics based on X-Ray diffraction method

ICS: 75.060

ISO/TC 193/SC 3

Secretariat: **SAC**

Voting begins on:
2025-03-18

Voting terminates on:
2025-06-10

This document is circulated as received from the committee secretariat.

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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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This document was prepared by Technical Committee ISO/TC 193, *Natural gas*, Subcommittee SC 3, *Upstream area*.

A list of all parts in the ISO /TC 193/SC 3 series can be found on the ISO website.

Natural gas upstream area — Determination and calculation of shale brittleness index — Part 1: Determination of shale mineral characteristics based on X-ray diffraction method

Natural gas upstream area — Determination and calculation of shale brittleness index — Part 2: Determination of shale mechanical characteristics based on triaxial testing method

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.

Introduction

This document has been developed to address the need for evaluating shale brittleness in the production of shale gas. In order to boost shale gas production, it is essential to create flow paths within shale gas reservoirs through hydraulic fracturing. The shale brittleness index, serving as a crucial parameter for forecasting the complexity of hydraulic fracturing cracks, is a vital benchmark for identifying high-quality shale gas reservoirs. Therefore, a standardized approach for calculating the shale brittleness index can assist stakeholders, including oil companies, oilfield service providers, investment firms, and governments, in accurately pinpointing "sweet spots" within shale gas reservoirs, selecting promising areas with development potential, and facilitating efficient shale gas development.

In the global shale gas production industry, two types of optimal methods for characterizing shale brittleness index are preferred, namely the mineral composition method and the rock mechanics method, due to their theoretical effectiveness, operational generality, and result reliability. ISO 24835 is developed on the basis of these two methods.

ISO 24835 *Natural gas — Upstream area — Determination and calculation of shale brittleness index* consists of two parts.

Part 1: Determination of shale mineral characteristics based on X-Ray diffraction method

Part 2: Determination of shale mechanical characteristics based on triaxial testing method

This document is Part 1.

Natural gas upstream area — Determination and calculation of shale brittleness index —

Part 1: Determination of shale mineral characteristics based on X-Ray diffraction method

1 Scope

This document specifies the principles, instruments, materials, experimental conditions, and the sampling and composition analysis steps required for testing the mineral composition using X-ray diffraction method, as well as the method and precision requirements for calculating shale brittleness index based on mineral composition.

This document is applicable to reservoir quality evaluation and sweet spot identification in shale gas production.

2 Normative references

The following documents are essential to the application of the standard. For dated references, only the edition cited applies. For undated references, their latest edition of the referenced document (including any amendments) applies.

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

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

ISO 14532, *Natural gas — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 14532 and the following 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

brittle mineral

a mineral that exhibits virtually no plastic deformation prior to fracturing under external forces

Note 1 to entry: Through extensive research and practice, brittle minerals are typically found in global shale gas reservoirs, include quartz, plagioclase, kalifeldspar, calcite, dolomite, and pyrite (see References [2] to [9]), and also possibly include ankerite and siderite.

[SOURCE: ISO 18684:2020, 3.4 modified — minerals with the characteristic of brittleness are defined as brittle minerals]

3.2

shale brittleness index

an index derived from a particular brittleness characterization principle and algorithm among various options, used for comparing the brittleness levels of different shales

3.3

shale mineral brittleness index

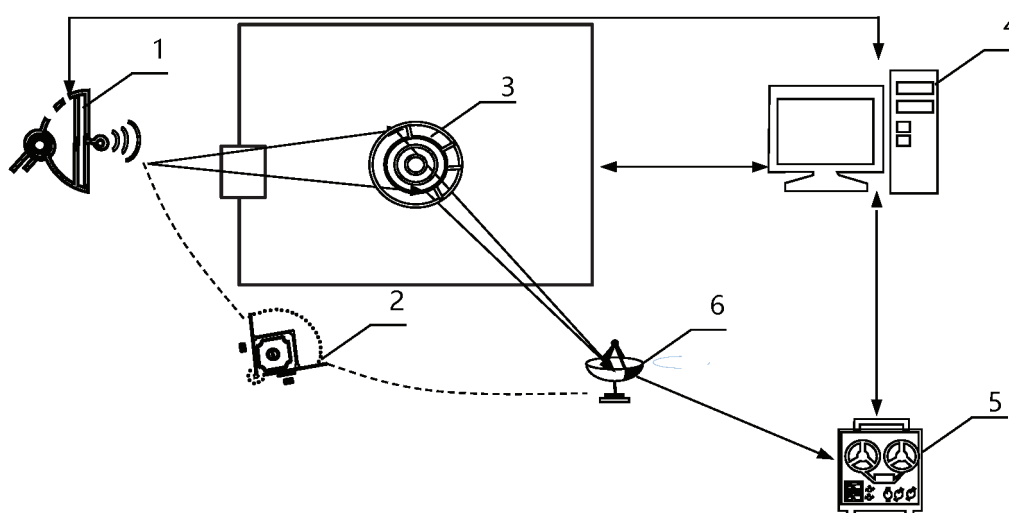
the shale brittleness index derived through calculation based on the mineral composition of the shale

4 Principles

Each crystal mineral features a specific X-ray diffraction pattern, and the intensity of characteristic peaks is functionally proportional to the specific mineral content. Mixed aluminum oxide powder (5.2.5), with traceable main peak position, uniformly in a 1:1 ratio by mass with a single mineral sample powder (5.2.6). Determine the X-ray diffraction pattern of the mixed powder using an X-ray diffractometer (Figure 1). Identify the characteristic peaks of aluminum oxide powder and the single mineral sample and calculate their integral intensities. Obtain the reference intensity of the single mineral sample based on the intensity of the characteristic peak of the aluminum oxide powder. Using the same method, obtain the reference intensities of other potential mineral components in the shale.

Then, test the X-ray diffraction pattern of the shale powder sample. By comparing with typical mineral X-ray diffraction data, identify the mineral components present in the shale and calculate the integral intensities of each mineral's characteristic peaks. Combining the reference intensities of minerals, use Formula (1) to calculate the content of various minerals in the shale.

Calculate the shale mineral brittleness index (3.3) as the percentage of brittle minerals (3.1) in the total mineral content. The process for determining and calculating the shale mineral brittleness index is shown in Figure 2.



Key

- 1 X-ray generator
- 2 angular instrument
- 3 sample