

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 540

DETERMINATION OF FUSIBILITY OF FUEL ASH

1st EDITION

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Amendment 1 – November 1971 – to ISO Recommendation R 540-1967

Amendment 1
to ISO Recommendation R 540-1967

DETERMINATION OF FUSIBILITY OF FUEL ASH

Section 3, TEST CONDITIONS, clause 3.2

Delete the 6th and 7th lines.

BRIEF HISTORY

Amendment 1 to ISO Recommendation R 540-1967, *Determination of fusibility of fuel ash*, was drawn up by Technical Committee ISO/TC 27, *Solid mineral fuels*, the Secretariat of which is held by the British Standards Institution (BSI).

Draft ISO Recommendation No. 1933 was drawn up on this subject, and was circulated to all the ISO Member Bodies for enquiry in April 1970. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Iran	Switzerland
Belgium	Italy	Thailand
Chile	Korea, Rep. of	Turkey
Czechoslovakia	Netherlands	U.A.R.
Denmark	New Zealand	United Kingdom
France	Poland	U.S.A.
Germany	Portugal	U.S.S.R.
Greece	South Africa, Rep. of	Yugoslavia
India	Sweden	

The following Member Body opposed the approval of the Draft :

Canada

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as AMENDMENT 1 to ISO Recommendation R 540-1967.

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BRIEF HISTORY

The ISO Recommendation R 540, *Determination of Fusibility of Fuel Ash*, was drawn up by Technical Committee ISO/TC 27, *Solid Mineral Fuels*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee began in 1951 and led, in 1961, to the adoption of a Draft ISO Recommendation.

In June 1963, this Draft ISO Recommendation (No.573) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Argentina	Iran	Spain
Australia	Italy	Sweden
Austria	Japan	Switzerland
Canada	Netherlands	Turkey
Chile	New Zealand	United Kingdom
Czechoslovakia	Poland	U.S.S.R.
Denmark	Portugal	Yugoslavia
France	Republic	
Germany	of South Africa	
India	Romania	

One Member Body opposed the approval of the Draft:

Belgium.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in January 1967, to accept it as an ISO RECOMMENDATION.

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DETERMINATION OF FUSIBILITY OF FUEL ASH

1. SCOPE

This ISO Recommendation describes the method of determining the characteristic fusion temperatures of ash from hard coal, brown coal and lignites, and coke.

2. PRINCIPLE

A test piece made from the ash is heated under standard conditions and continuously observed. The temperatures at which characteristic changes of shape occur are recorded. The characteristic temperatures are the following:

Deformation temperature (symbol A)

The temperature at which the first signs of rounding of the tip or edges of the test piece occur (see Note 1 below).

Hemisphere temperature (symbol B)

The temperature at which the test piece forms approximately a hemisphere, i.e. when the height becomes equal to half the base diameter as visually observed.

Flow temperature (symbol C)

The temperature at which the ash 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.

Although the determination is usually carried out in a reducing atmosphere, additional information can sometimes be obtained by carrying out a further determination in an oxidizing atmosphere (see Note 2 below).

NOTES

1. Shrinkage or distortion of the test piece should be ignored if the tip and edges of the test piece remain sharp.
2. In general, the reducing atmospheres recommended give the lowest characteristic temperatures.

3. TEST CONDITIONS

3.1 Shape of test piece

The test piece should have sharp edges to facilitate observation and should not bend during the determination.

The mass of the test piece should be such as to ensure equalization of temperature within the test body. Hence too large dimensions should be avoided.

The following shapes are acceptable:

- (a) Pyramid, the base of which is an equilateral triangle and the height between two and three times the side of the base, but not exceeding 19 mm.
- (b) Cube of side 3 to 7 mm.
- (c) Right cylinder of height 3 to 9 mm and diameter 3 to 9 mm, the height being equal to the diameter.

3.2 Test atmosphere

The reducing atmosphere (see Note 1 below) is conveniently obtained by introducing into the furnace one of the following mixtures of gases at a minimum linear rate of flow past the test piece of 40 cm/min, calculated at ambient temperature (see Note 2 below):

- | | |
|---|-------|
| (a) 60% carbon monoxide $\pm 5\%$ with 40% carbon dioxide $\pm 5\%$ | } v/v |
| (b) 50% hydrogen $\pm 5\%$ with 50% carbon dioxide $\pm 5\%$ | |

Other reducing atmospheres or methods of obtaining them may be used, provided that it has been established that they give the same results.

An oxidizing atmosphere is obtained with air or carbon dioxide, but the rate of flow is not critical.

NOTES

1. When using these reducing atmospheres, the gases emerging from the furnace will contain a proportion of carbon monoxide; it is essential, therefore, to ensure that these gases are vented to the outside atmosphere, preferably by means of a hood or an efficient fan system.
2. The rate of gas flow is not critical, provided that it is sufficient to prevent any leaking of air into the furnace. The rate of 40 cm/min is a minimum which has been determined experimentally.

4. APPARATUS

4.1 Furnace

A furnace, preferably electrically heated, which satisfies the following conditions:

- (1) That it is capable of reaching the maximum temperature at which the properties of the ash are to be determined (a temperature of 1500 °C or higher may be required for many ashes).
- (2) That it provides an adequate zone of uniform temperature in which to heat the test piece.
- (3) That it provides means of heating the test piece at a uniform rate within the range of 3 to 7 °C/min.
- (4) That it is possible to maintain around the test piece an atmosphere of composition within the desired limits.
- (5) That it provides means of observing the change of shape of the test piece during heating.

4.2 Pyrometer

The temperature should be measured by means of a platinum-rhodium/platinum thermocouple. The accuracy of the pyrometer should be checked from time to time (see Notes 1 and 2, clause 4.5, p. 7).

4.3 Mould for preparing the test piece

4.4 Support for the test piece

The support should be of such a material that it neither becomes distorted, nor reacts with nor absorbs the ash, during the determination.

While supports of sintered alumina, fine-textured mullite or platinum on a refractory support are generally satisfactory, difficulties may arise with individual ashes and only experience can show which support is the best for use in such circumstances.