SLOVENSKI STANDARD
SIST-TS CEN/TS 15404:2007

01-marec-2007

Trdno alternativno gorivo - Metode za določanje karakteristiţnih temperatur taliţa pepela

Solid recovered fuels - Methods for the determination of ash melting behaviour by using characteristic temperatures

Feste Sekundärbrennstoffe - Verfahren zur Bestimmung des Schmelzverhaltens der Asche bei Anwendung charakteristischer Temperaturen

Combustibles solides de récupération - Méthodes pour la détermination de la fusibilité des cendres

Ta slovenski standard je istoveten z: **CEN/TS 15404:2006**

ICS:

75.160.10	Trda goriva	Solid fuels

SIST-TS CEN/TS 15404:2007 **en**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 15404

October 2006

ICS 75.160.10

English Version

Solid recovered fuels - Methods for the determination of ash melting behaviour by using characteristic temperatures

Combustibles solides de récupération - Méthodes pour la détermination de la fusibilité des cendres

Feste Sekundärbrennstoffe - Verfahren zur Bestimmung des Schmelzverhaltens der Asche bei Anwendung charakteristischer Temperaturen

This Technical Specification (CEN/TS) was approved by CEN on 25 March 2006 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. CEN/TS 15404:2006: E

Contents

Page

Foreword

This document (CEN/TS 15404:2006) has been prepared by Technical Committee CEN/TC 343 “Solid recovered fuels”, the secretariat of which is held by SFS.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Ash melting is a complex process where also shrinkage, sintering and swelling can occur.

The test method specified in this Technical Specification provides information about fusion and melting behaviour of the composite inorganic constituents of the fuel ash at high temperatures.

The test method is empirical. The ash used for the test is a homogeneous material, prepared from the fuel, and the determination is performed at a controlled rate of heating in a controlled atmosphere. In contrast, under full-scale conditions, the complex processes of combustion and fusion involve heterogeneous mixtures of particles, variable heating rates and gas compositions.

The terms ash fusibility and ash softening are synonyms to ash melting.

1 Scope

This Technical Specification specifies a method for the determination of shrinking, deformation, hemisphere and flow temperature for characterizing the ash melting behaviour of all solid recovered fuels. It is primarily intended for use by laboratories, producers, suppliers and purchasers of solid recovered fuels but is also applicable by authorities and inspection organisations.

NOTE This Technical Specification is based on ISO 540:1995 and DIN 51730:1998.

2 Normative references

The following referenced documents are indispensable for the application of this Technical Specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TS 15357:2006, *Solid recovered fuels — Terminology, definitions and descriptions*

CEN/TS 15403, *Solid recovered fuels — Methods for the determination of ash content*

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

3 Terms and definitions

For the purposes of this Technical Specification, the terms and definitions given in CEN/TS 15357:2006 and the following apply.

3.1
shrinking temperature
ST
temperature at which shrinking of the test piece occurs. This temperature is defined as when the area of the test piece falls below 95 % of the original test piece area at 550 °C

NOTE Shrinking can be due to liberation of carbon dioxide, volatile alkali compounds, and/or sintering.

3.2
deformation temperature
DT
temperature at which the first signs of roundings of the edges due to melting of the test piece occur

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 is spread out over the supporting tile in a layer, the height of which as half of the height of the test piece at the hemisphere temperature

NOTE Half of the height of the test piece is defined due to frequently occurring bubbling effects. This is especially important for automatic image evaluation. This definition is different to other standards.

4 Principle

A test piece made from the prepared ash is heated up with constant rate whereas the deformation is continuously observed. The temperatures at which characteristic changes of the shape occur are recorded.

5 Reagents

5.1 **Water**, demineralised.

5.2 **Dextrin**, 100g/l solution: Dissolve 10 g of dextrin in 100 ml water.

5.3 **Ethanol**, with a purity of greater than 95 %.

5.4 **Carbon dioxide**.

5.5 **Gas mixture**, of carbon dioxide (5.4) and carbon monoxide: A volume fraction of 55 % to 65 % carbon monoxide is mixed with a volume fraction of 35 % to 45 % carbon dioxide (5.4).

5.6 **Gold wire**, with a diameter of 0,5 mm or greater, or a **gold plate**, with a thickness of 0,5 mm to 1,0 mm, a purity of at least 99,99 % and a certified melting point (e.g. 1 064 °C).

5.7 **Nickel wire**, with a diameter of 0,5 mm or greater, or a **nickel plate,** with a thickness of 0,5 mm to 1,0 mm, a purity of at least 99,9 % and a certified melting point (e.g. 1 455 °C).

NOTE Nickel is used for reducing atmosphere.

5.8 **Palladium wire**, with a diameter of 0,5 mm or greater, or a **palladium plate**, with a thickness of 0,5 mm to 1,0 mm, a purity of at least 99,9 % and a certified melting point (e.g. 1 554 °C).

6 Apparatus and auxiliary means

6.1 **Furnace**, electrically heated, capable to:

a) reach the maximum temperature (≥ 1 500 °C) at which the properties of the ash shall be determined;

b) provide and maintain an adequate zone of uniform temperature which to heat the test piece(s) in;

c) provide means for heating the test piece(s) at an uniform rate from 550 °C upwards;

d) maintain the required test atmosphere around the test piece(s);

e) provide means for observing the change of shape of the test piece(s) during heating.

6.2 **Dish**, consisting of inert material, such as porcelain, silica, platinum, with a depth from 10 mm to 20 mm and of such a size that the sample loading does not exceed 0,1 g/cm^2 bottom area.

6.3 **Pyrometer,** consisting of a platinum/platinum-rhodium thermocouple.

6.4 **Mould**, of brass, stainless steel or other suitable material for preparing the test piece.

6.5 **Spring pressure hand press** for producing the test piece, capable of providing a spring pressure of about 1,5 N/mm^2.

6.6 **Support** for the test piece, consisting of such an inert material that it is neither distorted nor absorbs the ash during the determination.

NOTE Supports of sintered alumina or fine-textured mullite are generally satisfactory but difficulties can arise with individual ashes, in which case a non-absorbent interface such as platinum foil can be used between the original support and the test piece.

6.7 Flowmeters, two, for measuring the components of the reducing gases.

NOTE If using oxidising gas, it is not necessary to measure the flow rate.

6.8 Grinding device, such as agate mortar and pestle.

6.9 Test sieve, of aperture 0,075 mm and diameter of at least 100 mm complete with lid and receiver, in accordance with ISO 3310-1.

6.10 Optical instrument, such as a camera or video equipment, for observing the profile of the test piece throughout the determination.

7 Test conditions

7.1 Test atmosphere

The atmosphere shall be oxidising or reducing, depending on the application. Use air or carbon dioxide (5.4) for an oxidising atmosphere.

For a reduced atmosphere, introduce into the furnace a mixture of

- 55 % volume fraction to 65 % volume fraction carbon monoxide with 35 % volume fraction to 45 % volume fraction carbon dioxide

and

- 45 % volume fraction to 55 % volume fraction hydrogen with 45 % volume fraction to 55 % volume fraction carbon dioxide

at a minimum linear rate of flow past the test piece between 100 mm/min to 250 mm/min calculated at ambient temperature.

NOTE The flow rate is not very critical, provided that it is sufficient to prevent any leakage of air into the furnace in case of reducing atmosphere. However, the same flow rate level is also recommended for oxidising atmosphere. For open-type furnaces with a larger diameter, a flow rate of about 400 mm/min can be needed for reducing atmosphere. In all cases it should also be referred to manufacturer instructions. The flow rate for rotameter adjustment can be calculated by multiplying the flow rate, expressed in millimetres per minute, with the inside cross-section area of the furnace tube converting into litres per minute.

WARNING — When using reduced atmosphere as given above, the gases emerging from the furnace will contain a proportion of carbon monoxide; therefore it is essential to ensure that these gases are vented to the outside atmosphere, preferably by means of a hood or an efficient fan system. If hydrogen is used in the reducing atmosphere, care shall be taken to prevent an explosion occurring by purging with carbon dioxide both prior to the introduction of the hydrogen and after the hydrogen supply is shut off.

7.2 Shape of test piece

The test piece shall have sharp edges to facilitate observation.

The mass of the test piece shall be such as to ensure equalisation of the temperature within the test piece. Hence, dimensions that are too large shall be avoided. The test piece shall be an upright cylinder with a height of 3 mm to 5 mm and a diameter equal to the height (see Figure 1).