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Insulating refractory products - Terminology, classification and methods of test for high temperature insulation wool products

Feuerfeste Erzeugnisse für Wärmedämmzwecke - Teil 1: Terminologie, Klassifizierung und Prüfverfahren für Erzeugnisse aus Hochtemperaturwolle zur Wärmedämmung

Produits réfractaires isolants - Terminologie, classification et méthodes d'essai pour produits à base de laine isolante à haute température

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English Version

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Foreword

This document (EN 1094-1:2008) has been prepared by Technical Committee CEN/TC 187 “Refractory products and materials”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2009, and conflicting national standards shall be withdrawn at the latest by January 2009.

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1 Scope

This European Standard defines terms for those refractory products and materials which are classed as high temperature insulation wools (HTIW). It also establishes the classification of insulating refractory products made from HTIW and specifies methods for determining the thickness, bulk density, resilience, permanent linear change, tensile strength and moisture and organic matter content of HTIW products.

It applies to HTIW bulk wool, blankets, felts, mats, boards, pre-formed shapes and papers, with the exception of products delivered in a wet state.

Further test procedures are in development and will be included once they have been ratified. These include a 3 point bend test for boards, a length weighted fibre diameter measurement technique by Scanning Electron Microscope, shot content measurement (dry and wet methods) and thermal conductivity measurement. There is a shot content method described in ISO 10635 and there is a thermal conductivity technique described in ASTM C201.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 1094 (all parts), *Insulating refractory products*

EN ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General terms and definitions

3.1.1
high temperature insulation wool
HTIW
man-made mineral wool suitable for use as heat-insulating materials above a temperature of 600°C and divided into amorphous alkaline earth silicate wools (AES), aluminosilicate wools (ASW) and the polycrystalline wools (PCW) with a classification temperature greater than 1 000 °C

3.1.2
wool
non-directional agglomeration of fibres with varying diameter and length distributions

3.1.3
fibre
particles with a length to diameter proportion of L/D > 3:1

3.1.4
AES-wool
amorphous wools with a typical composition range as given in Table 1

Table 1 — Typical Composition range of AES-wool

Component	Percentage by mass
CaO + MgO	18 to 43
SiO_2	50 to 82
$Al_2O_3 + TiO_2 + ZrO_2$	< 6
Other oxides	< 1

3.1.5
aluminosilicate wool
ASW
amorphous wools, subdivided into:

a) aluminosilicate wool ($Al_2O_3 + SiO_2$) with a composition range as given in Table 2; and

b) alumino zirconium silicate wool ($Al_2O_3 + ZrO_2 + SiO_2$) with a composition range as given in Table 3

Table 2 — Typical Composition range of aluminosilicate wool

Component	Percentage by mass
Al_2O_3	46 to 56
SiO_2	44 to 54
Other oxides	< 1

Table 3 — Typical Composition range of alumino zirconium silicate wool

Component	Percentage by mass
Al_2O_3	< 37
SiO_2	> 48
ZrO_2	< 20
Other oxides	< 1

3.1.6
polycrystalline wool
PCW
wool with a typical composition range as given in Table 4

Table 4 — Typical Composition range of polycrystalline wool

Component	Percentage by mass
Al_2O_3	72 to 97
SiO_2	3 to 28
Other oxides	< 0,1

3.1.7
resilience
ability of HTIW products to spring back after being compressed to 50 % of their initial thickness

3.1.8
tensile strength
apparent maximum tensile stress that the material can withstand

NOTE It is expressed in Pascals (Pa). It is given together with the bulk density determined by subclause 7.2

3.2 Materials and products made from high temperature insulation wool (HTIW)

3.2.1
bulk wool
wool in the state as produced before conversion into other products

NOTE 1 Bulk wool is available as:

a) wool with long fibres with or without finish (lubricant);

b) wool with chopped fibres with variable length due to their application.

NOTE 2 Lubricant is added to the fibres to keep them flexible for further processing the wool products. Typically, the wool products are thermally treated after production to remove the lubricant.

3.2.2
mat
flexible, non-needled wool without further bonding agent

3.2.3
blanket
flexible, needled mat, free of binders, with nominally determined dimensions

NOTE The mat is processed with barbed felt needles. In consequence, the product becomes denser and stronger.

3.2.4
felt
flexible, non-needled product with further bonding agents

3.2.5
module
blanket formed into thick sections by needling, stacking or folding sheets, compressed to a higher density and typically supplied with integral anchoring systems

NOTE Typically, the bulk density of modules is between 160 kg/m^3 and 300 kg/m^3. Modules can be of a complex shape.

3.2.6
paper
flexible insulating material formed on a paper-making machine

NOTE Typically, thin shaped HTIW products are kept together by an organic binder (e.g. latex).

3.2.7
board
rigid flat sheet, usually containing inorganic and/or organic binders, produced by a wet process fired or unfired

3.2.8
pre-formed product and shapes
rigid shape with the addition of inorganic and/or organic binders, fired or unfired

NOTE Depending on their production process pre-formed products are subdivided into:

a) vacuum shaped products;

b) mixed products wherein different types of HTIW but also refractory fillers are put together;

c) plastic shaped products;

d) laminated pre-formed products wherein boards, paper or felts are stuck together (on top of each other or rolled);

e) die-cut products made of blankets, boards or paper.

3.2.9
yarn
bulk HTIW twisted into a continuous thread, with or without the addition of reinforcing filaments

3.2.10
rope
yarn twisted to a rope, with or without reinforcing

NOTE Ropes can be reinforced by glass or metal fibres.

3.2.11
cloth
yarn woven to cloth

3.2.12
mouldable/castable/mastic product
product used for moulding, casting or repairs.

NOTE Mouldable products of HTIW are, for example, added in different proportions to unshaped refractory products as defined in EN 1402-1.

4 Classification temperature

The product is classified according to the temperature at which the shrinkage obtained by the permanent linear change in dimensions test, as described in subclause 7.4, does not exceed a given value.

According to the nature of the product, the shrinkage value shall not exceed:

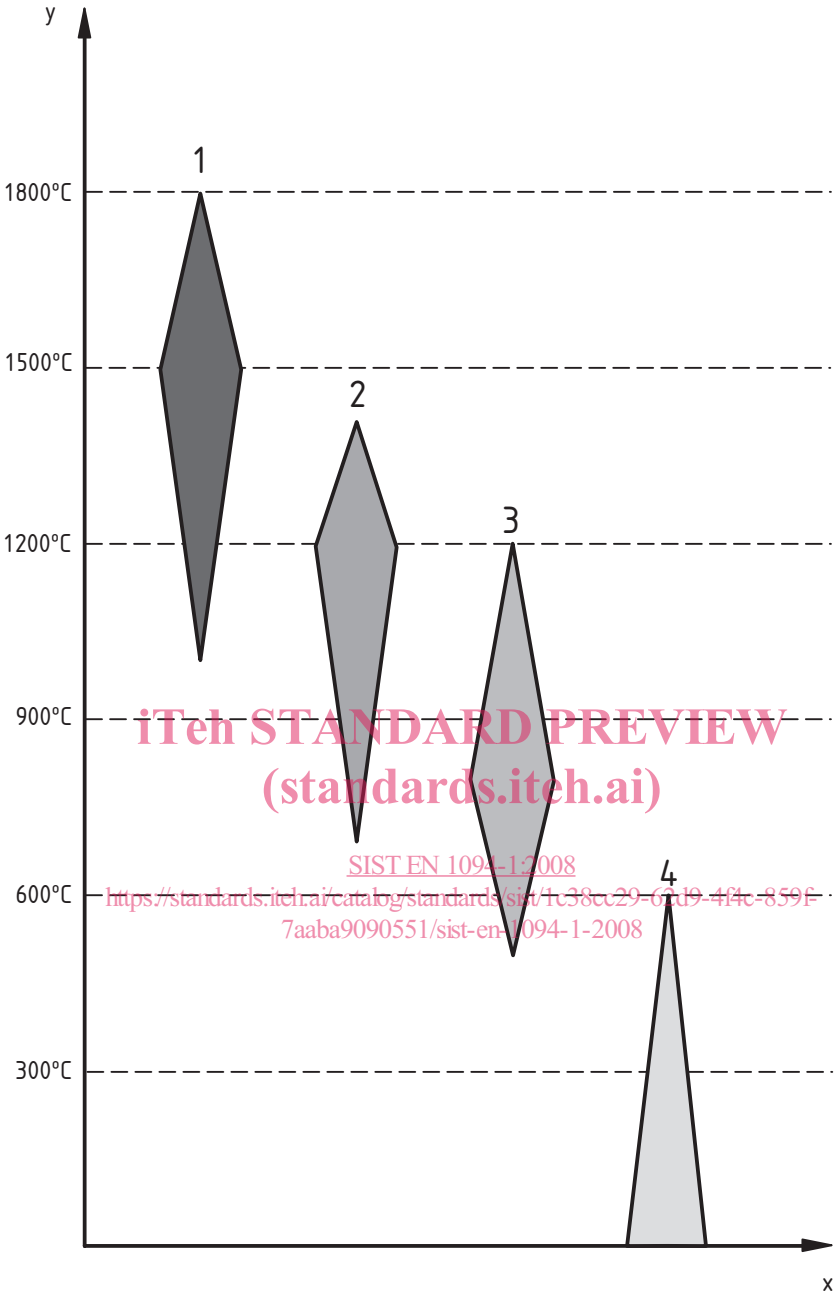
— 2 % for boards and preformed shapes;

— 4 % for blankets, felts, mats and papers.

The temperature shall be reported to the nearest 50°C, starting at 850°C and going up to 1 800°C in 50°C increments.

NOTE Classification temperature does not imply that the product can be used continuously at this temperature. In practice maximum continuous use temperature for amorphous HTIWs will typically be approximately 100°C to 150°C lower than the classification temperature. Polycrystalline wool can usually be used up to its classification temperature. The atmosphere, application (e.g. single use vs. extended) and contact with other substances should all be considered carefully when selecting the type of high temperature insulation wool for a particular application.

Typical application temperatures are shown in Figure 1.



Key
X Type of wool
Y Temperature °C
1 Polycrystalline wool
2 Alumino-Silicate and Alumino-Zirconium-Silicate Wool
3 Alkaline-Earth-Silicate Wool (AES)
4 Mineral wools (Glass and Rock wool)

NOTE The width of the polygon shows the proportion of a wool type used in the corresponding temperature range.

Figure 1 —Typical application temperatures of HTIW

5 Number of test pieces

The number of items to be tested shall be determined by agreement between the parties. The number of test pieces per item shall be determined in accordance with Table 5.

6 Preparation of test pieces

When the material to be tested is in a roll form, any compressed material at the extreme ends shall be excluded. A strip shall be cut perpendicular to the length across the full material width, of sufficient size for the different tests planned.

From the strip, cut the required number of test pieces of required dimensions, using a template, a sharp knife, a saw, or other method which will not damage the sample. Avoid excess pressure as this may crush the product.

Table 5 — Summary of test methods and designations, applicability to product types and number of test pieces per item required

Clause	Test	Material	Number of test pieces
6.1	Measured thickness: 725 Pa method or 350 Pa method	Blanket, Felt, Mat, Board	3
	For HTIW 50 kPa method, excluding AES where 10 kPa method is used.	Paper	3
6.2	Bulk density	Blanket, Felt, Mat, Board, Paper	3
6.3	Resilience	Blanket, Felt, Mat	3
6.4	Permanent linear change on heating	Blanket, Felt, Mat, Board, Paper	3
6.6	Tensile strength	Blanket, Felt, Paper	5
6.6	Moisture and organic content	Bulk wool, Blanket, Felt, Mat, Board, Paper	3

7 Test methods

7.1 Determination of the measured thickness

7.1.1 General

Because of packing, transport and storage, flexible HTIW products often show differences between measured and nominal thickness as given by the manufacturer.

7.1.2 Principle

Determination of the measured thickness of a product subjected to a compressive stress which depends on its nominal bulk density.