SIST

SLOVENSKI STANDARD
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Sodobna tehnična keramika - Mehanske lastnosti keramičnih vlaken pri visokih temperaturah v nereaktivnem okolju - Določitev lezenja po metodi hladnega spajanja (cold end method)

Advanced technical ceramics - Mechanical properties of ceramic fibres at high temperature in a non-reactive environment - Determination of creep behaviour by the cold end method

Hochleistungskeramik - Mechanische Eigenschaften von Keramikfasern bei hohen Temperaturen in einer reaktionsfreien Umgebung - Bestimmung des Kriechverhaltens im Kaltverbindungsverfahren

Céramiques techniques avancées - Propriétés mécaniques des fibres céramiques à haute température sous environnement non-réactif - Détermination du comportement au fluage par la méthode des mors froids

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Advanced technical ceramics - Mechanical properties of ceramic fibres at high temperature in a non-reactive environment - Determination of creep behaviour by the cold end method

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Foreword

This document (EN 15365:2010) has been prepared by Technical Committee CEN/TC 184 “Advanced technical ceramics”, 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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

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1 Scope

This European Standard specifies the conditions for the determination of the tensile creep deformation and failure behaviour of single filaments of ceramic fibres at high temperature and under test conditions that prevent changes to the material as a result of chemical reaction with the test environment.

This European Standard applies to continuous ceramic filaments taken from tows, yarns, braids and knittings, which have strains to fracture less than or equal to 5 %.

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 60584 (all parts), *Thermocouples*

CEN/TR 13233:2007, *Advanced technical ceramics — Notations and symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TR 13233:2007 and the following apply.

3.1
creep
time-dependent increase of gauge length starting from the time when the constant specified level of force is reached

3.2
creep threshold temperature
T_t
minimum temperature at which creep is detected

3.3
specimen temperature
T
temperature which varies along the fibre length in the cold grips case

NOTE See 8.2.

3.4
specimen temperature in the zone
T_i
temperature defined as: $T_t \leq T_i \leq T_t + i\,\Delta T$

3.5
total length
L
total length of the ceramic filament between the grips

3.6
length
L_i
length of the ceramic filament at temperature T_i

3.7
initial effective cross sectional area
A_0
initial cross sectional area of the ceramic filament within the gauge length

3.8
applied tensile force
F
constant force applied to the ceramic filament during the test

3.9
applied tensile stress
σ
applied tensile force divided by the initial cross sectional area

3.10
longitudinal deformation
ΔL
change in the total length of the ceramic filament caused by creep

3.11
longitudinal deformation
ΔL_i
change of the filament caused by creep at temperature T_i

3.12
tensile creep strain
$\varepsilon_{cr(T)}$
relative change in length in the controlled zone at time *t*, caused by creep at the temperature T

NOTE The value corresponding to rupture is denoted $\varepsilon_{cr,m}$.

3.13
creep rupture time
$t_{cr,m}$
time elapsed from the moment when loading is completed until the moment of rupture

3.14
creep strain rate
$\dot{\varepsilon}_{cr(T)}$
change in creep strain per unit time at time t at the temperature T_i

3.15
creep type
primary, secondary or tertiary creep

3.16
primary creep
part of the creep strain versus time curve which presents a decreasing creep strain rate

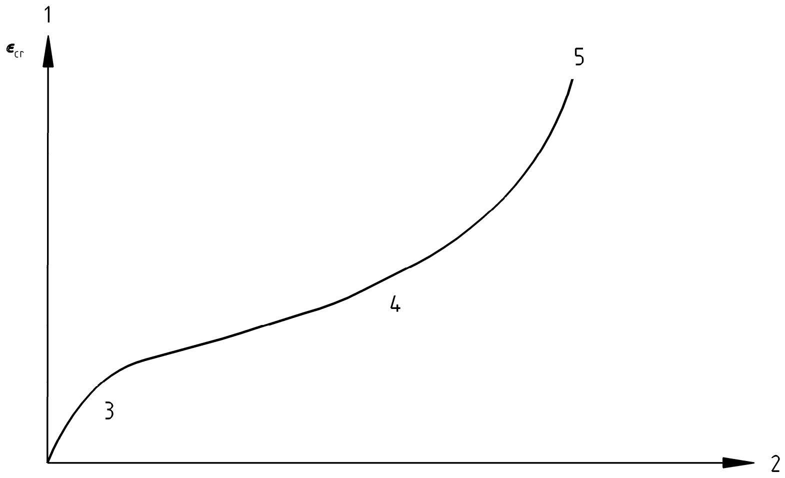
NOTE See Figure 1.

3.17
secondary creep
part of the creep strain versus time curve which presents a constant creep strain rate

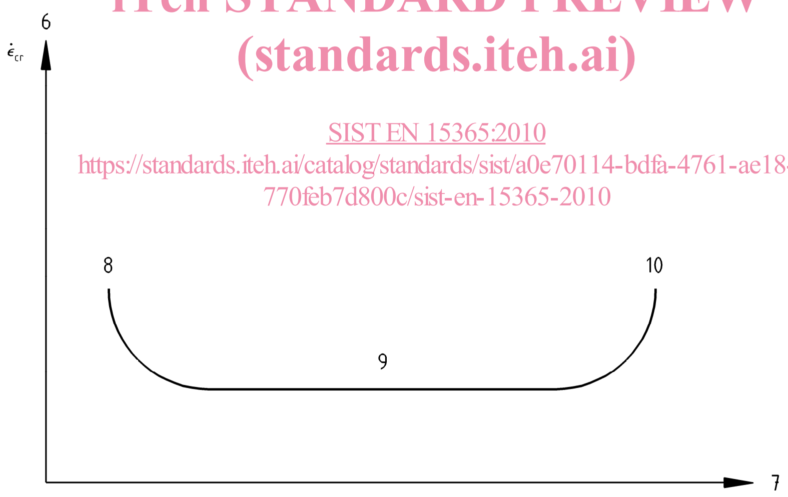
NOTE See Figure 1.

3.18
tertiary creep
part of the creep strain versus time curve which presents an increasing creep strain rate

NOTE See Figure 1.



a) Creep strain versus time



b) Creep strain rate versus time

Key

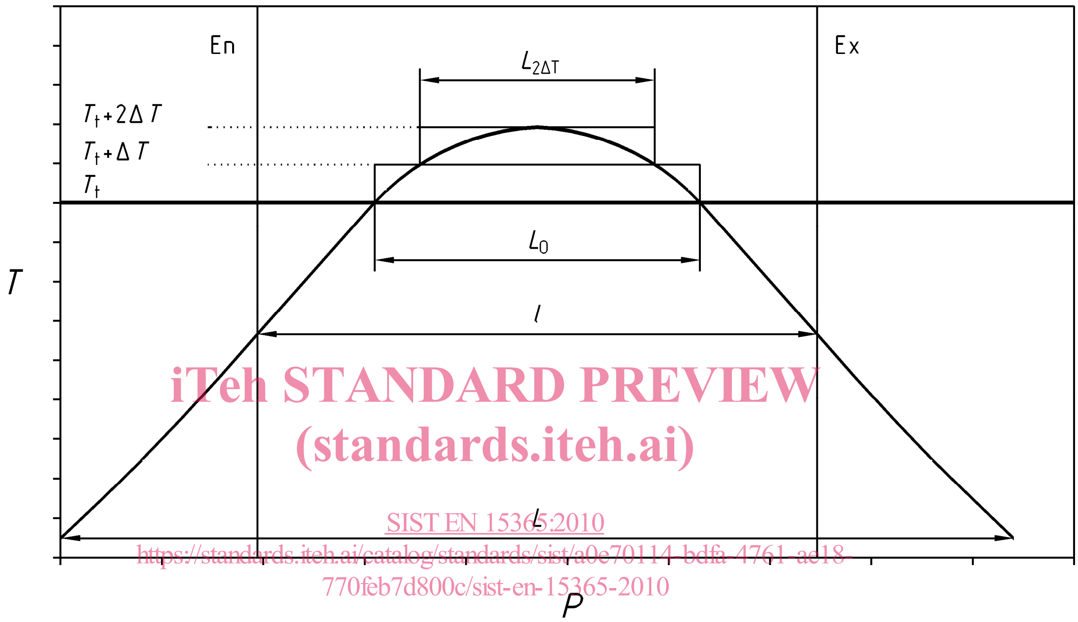
1 Creep strain ε_{cr}
2 Time t
3 Primary creep
4 Secondary creep
5 Tertiary creep
6 Creep strain rate $\dot{\varepsilon}_{cr}$ (creep strain with time)
7 Time
8 Primary creep
9 Secondary creep
10 Tertiary creep

Figure 1 — Creep strain and creep strain rate versus time curves

4 Principle

A ceramic filament is heated to the test temperature and loaded in tension until a specified level of force. This force is maintained at a constant level for a specified time or until rupture. The variation in the ceramic filament length is recorded in relation to time.

The specimen is held in cold grips and heated by a furnace. This experimental configuration provokes temperature variations along the filament, which have to be taken into account in order to determine the creep properties as function of temperature. Prior to testing, the temperature profile inside the furnace is established over the temperature range. The temperature range is then divided into several temperature zones defined by the operator, according to the following graph.



Key

T Temperature (°C)

l Length of the furnace

P Position (mm)

En Entrance

Ex Exit

L total length of the ceramic filament between the groups

$L_0 = L_{2\Delta T} + 2L_{\Delta T}$

where

$L_{2\Delta T}$ is the furnace length where the temperature T is in the range $T_t + \Delta T \leq T \leq T_t + 2\,\Delta T$;

$L_{\Delta T}$ is the furnace length where the temperature T is in the range $T_t \leq T \leq T_t + \Delta T$.

Figure 2 — Temperature profile in furnace

If T_t is considered to be the lowest temperature at which creep is observed, the temperature profile can be divided in several intervals as a function of T_t and ΔT, where ΔT is the difference in temperature between the different zones, fixed by the operator.

If we consider *i*, the entire number of zones, and L, the total fibre length, then we can define the following lengths:

— L_{20} is the furnace length where the temperature T is in the range 20 °C $\leq T \leq T_t$;