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EUROPEAN STANDARD

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English version

## Glass in building - Special basic products - Glass ceramics - Part 2-1 Definitions and general physical and mechanical properties

Verre dans la construction - Produits de base spéciaux -  
Partie 2-1 Vitrocéramiques - Définition et description

Glas im Bauwesen - Spezielle Basiserzeugnisse -  
Glaskeramik - Teil 2-1: Definitionen und allgemeine  
physikalische und mechanische Eigenschaften

This European Standard was approved by CEN on 21 June 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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## Foreword

This document (EN 1748-2-1:2004) has been prepared by Technical Committee CEN /TC 129 "Glass in Building", the secretariat of which is held by BIN.

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of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

This document supersedes EN 1748-2:1997.

This document consists of the following parts:

- EN 1748-2-1      *Glass in building - Special basic products - Glass ceramics –Part 2 – 1: Definitions and general physical and mechanical properties*
- EN 1748-2-2      *Glass in building - Special basic products - Glass ceramics – Part 2-2: Evaluation of conformity/Product standard*

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

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**EN 1748-2-1:2004 (E)****1 Scope**

This document defines, specifies and classifies glass ceramics for use in building. It indicates their chemical composition, main physical and mechanical properties, dimensional and minimum quality requirements (in respect of optical and visual faults).

This document applies to glass ceramics supplied in stock sizes or in cut sizes for final end use.

This document does not apply to final cut sizes having a dimension less than 100 mm or a surface area less than 0,05 m<sup>2</sup>.

**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 410, *Glass in building - Determination of luminous and solar characteristics of glazing*

**3 Terms and definitions**

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

**3.1****glass ceramics**

type of glass consisting of a crystalline and a residual glass phase. The glass is obtained by normal glass manufacturing methods, e.g. casting, floating, drawing, rolling and is subsequently subjected to a heat treatment which transforms, in a controlled manner, part of the glass into a fine grained crystalline phase. The glass ceramics has properties which deviate from those of the glass from which it was transformed.

**3.2****floated glass ceramics**

flat, transparent or translucent, clear or tinted glass ceramics having parallel and polished faces obtained by continuous casting and flotation on a metal bath.

**3.3****drawn sheet glass ceramics**

flat, transparent or translucent, clear or tinted glass ceramics obtained by continuous drawing, initially vertically, of a regular thickness and with the two surfaces fire polished.

**3.4****rolled glass ceramics**

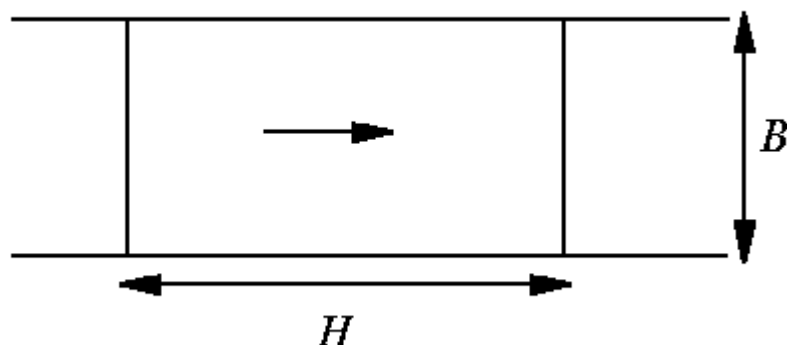
flat, transparent or translucent, clear or tinted glass ceramics obtained by rolling.

**3.5****cast glass ceramics**

flat, transparent or translucent, clear or tinted glass ceramics obtained by casting.

**3.6****nominal length, *H* and nominal width, *B***

pane length or pane width defined with reference to the direction of draw of the glass ceramics ribbon as shown in Figure 1.



### Key

→ Direction of draw

Figure 1 — Relationship of length, width and direction of draw

### 3.7

#### stock sizes

glass ceramics delivered in manufacturers standard stock sizes.

### 3.8

#### final cut size

pane of glass ceramics that has been cut down to the dimensions being required either for installation or processing into a final product e.g. insulating glass units.

### 3.9

#### optical faults

faults, which lead to distortions on the appearance of objects observed through the glass ceramics.

### 3.10

#### visual faults

faults, which alter the visual quality of the glass ceramics. They are spot faults and linear / extend faults.

### 3.11

#### spot faults

spot fault is a nucleus, which is sometimes accompanied by a halo of distorted glass ceramics. The dimension of a spot fault comprising a nucleus with a halo is obtained by multiplying the dimension of the nucleus by a factor of approximately 3.

### 3.12

#### linear / extended faults

these faults can be on or in the glass ceramics, in the form of deposits, marks or scratches that occupy an extended length or area.

### 3.13

#### edge defects

these defects can occur on the edge of a cut size piece in the form of entrant and emergent faults and / or bevels.

### 3.14

#### concentration, c

the sum of the lengths of gaseous inclusions greater than 1,0 mm in any circle of 400 mm diameter.

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## 4 Chemical composition

### 4.1 Principal Constituents

The magnitude of the proportions by mass of the principal constituents of all the glass ceramics products covered by this standard is as follows:

— Silicon dioxide	SiO <sub>2</sub>	50 % to 80 %
— Aluminium oxide	Al <sub>2</sub> O <sub>3</sub>	15 % to 27 %
— Lithium oxide	Li <sub>2</sub> O	0 % to 5 %
— Zinc oxide	ZnO	0 % to 5 %
— Titanium dioxide	TiO <sub>2</sub>	0 % to 5 %
— Zirconium dioxide	ZrO <sub>2</sub>	0 % to 5 %
— Magnesium oxide	MgO	0 % to 8 %
— Calcium oxide	CaO	0 % to 8 %
— Barium oxide	BaO	0 % to 8 %
— Sodium oxide	Na <sub>2</sub> O	0 % to 2 %
— Potassium oxide	K <sub>2</sub> O	0 % to 2 %
— Others		0 % to 5 %

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### 4.2 Tint

Body tinted glass ceramics is obtained by the addition of suitable materials.

## 5 Physical and mechanical characteristics

### 5.1 General characteristics

Conventional numerical values for the physical and mechanical characteristics of the glass ceramics used to manufacture basic product are given in Table 1. These values, for normal annealed glass ceramics (without any further toughening), are not precise requirements with which the glass ceramics shall strictly comply, but are the generally accepted figures for use in calculations where a high degree of accuracy is not required.



Table 1 — Physical and mechanical characteristics of glass ceramics

Characteristic	Symbol	Value and unit
Density (at 18 °C)	$\rho$	2500 kg/m <sup>3</sup> to 2600 kg/m <sup>3</sup>
Hardness (Knoop)	$HK_{0,1/20}$	6 to 7,5 GPa
Young's modulus (modulus of elasticity)	$E$	$9 \times 10^{10}$ Pa
Poisson's ratio	$\mu$	0,2
Characteristic bending strength	$f_{g,k}$	$45 \times 10^6$ Pa <sup>[1]</sup>
Specific heat capacity	$c_p$	$0,8 \times 10^3$ J/(kg*K) to $0,9 \times 10^3$ J/(kg*K)
Nominal value of average coefficient of linear expansion between 20 °C and 300 °C	$\alpha$	zero
Resistance against temperature differential and sudden temperature change		650 K <sup>[2]</sup>
Thermal conductivity	$\lambda$	1,5 W/(m*K)
Mean refractive index to visible radiation (380 nm to 780 nm)	$n$	1,5
Emissivity (corrected)	$\varepsilon$	0,837
<sup>[1]</sup> A design method will be made available from TC 129 WG8 (prEN 13473) <sup>[2]</sup> Generally accepted value that is influenced by edge quality and glass type		

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## 5.2 Definition of clear glass ceramics

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A glass ceramics product is defined as clear glass ceramics when it is not tinted and when the light transmittance of the glass ceramics material, unmodified by the possible presence of a coating or surface roughness,

- after any necessary pre-treatment
- measured according to EN 410
- rounded to the nearest 0,01

is greater than or equal to the value given in Table 2 for the nominal thickness of the glass ceramics product.

In order to measure the light transmittance characteristics of glass ceramics, to determine whether it can be classified as clear, it is necessary, in some cases, to carry out a pre-treatment:

- coatings on smooth surfaces have to be eliminated, without modifying the thickness of the glass ceramics substrate.
- rough surfaces, with or without coatings, have to be eliminated by smoothing and polishing. The thickness of the glass ceramics will be modified by this process.

The light transmittance of a glass ceramics substrate has to be measured with its surfaces in a polished condition.