



# SLOVENSKI STANDARD SIST ENV 12212:2000

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## Advanced technical ceramics - Unified method for classification

Advanced technical ceramics - Unified method for classification

Hochleistungskeramik - Einheitliches Verfahren zur Klassifizierung

Céramiques techniques avancées - Méthode unifiée de classification

Ta slovenski standard je istoveten z: **ENV 12212:1995**

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### **ICS:**

81.060.30      Sodobna keramika      Advanced ceramics

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**Advanced technical ceramics - Unified method for  
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unifiée de classificationHochleistungskeramik - Einheitliches Verfahren  
zur Klassifizierung**STANDARD PREVIEW**  
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Comité Européen de Normalisation  
Europäisches Komitee für Normung

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## Foreword

This European Prestandard has been prepared by the CEN/TC 184 "Advanced technical ceramics" of which the secretariat is held by BSI.

This scheme has been developed by international collaboration under the auspices of VAMAS Technical Working Area 14, and with support from the Commission of the European Communities, ASTM Institute of Standards Research and the Japan Fine Ceramics Association. Its construction has followed an international survey of requirements amongst manufacturing and user industries (Reference A1, see Annex A), discussions at an international workshop at Ispra, Italy, June 1990 (Reference A2, see Annex A), a consultant's study (Reference A3, see Annex A), and a final report of the work of VAMAS TWA14 (Reference A4, see Annex A).

CEN/TC 184 approved this European Prestandard by resolution 1/12/1992 during its seventh meeting held in Berlin, 1992-12-08/09.

According to the CEN/CENELEC Internal Regulation, the following countries are bound to announce this European Prestandard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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## 1 Scope

This European Prestandard describes a scheme by which advanced technical ceramics (see 3.) may be classified. The scheme has been devised to cover all types of advanced technical ceramic in the forms of inorganic precursors for ceramic powder production, powders, granular forms, fibres, whiskers, platelets, single crystals, consolidated polycrystalline ceramics, amorphous (glassy) and composite materials and components in block, thin film and coating forms. The structure of the classification is coded to be machine readable.

The classification does not cover:

- elemental carbon, except for specific ceramic forms such as diamond, vitreous carbon, or chemical vapour deposited (CVD) graphite;
- elemental silicon, other than when it forms an integral component of or precursor for an advanced technical ceramic;
- elemental germanium and other elemental or compound semi-metallic substances;
- traditional ceramics based on clay, including
  - whitewares (e.g. tableware and fine porcelain);
  - sanitary wares;
  - floor and wall tiles;
  - building ceramics (e.g. bricks and pipes);
- unshaped and shaped refractories for tonnage applications;

This standard does not specifically cover hardmetal (cemented carbide) products or products which are mainly glassy, but the scheme can in principle be extended to cover such products.

Its mode of use will be determined by the objective behind its use. **It is not the purpose of this standard to define how the scheme shall be used**, but examples are given of how it might be used. The user is able to define the coding combination and the level of detail to suit his particular purpose. This standard provides only a flexible framework within which this might be done.

## 2 Normative references

This European Prestandard contains, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and in the publications listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European prestandard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- EN 623-2      Advanced technical ceramics - Monolithic ceramics - General and textural properties - Part 2: Determination of density and porosity
- ENV 623-3      Advanced technical ceramics - Monolithic ceramics - General and textural properties - Part 3: Determination of grain size
- ENV 623-4      Advanced technical ceramics - Monolithic ceramics - General and textural properties - Part 4: Determination of surface roughness
- ENV 658-1      Advanced technical ceramics - Composite ceramics - Mechanical properties at room temperature - Part 1: Determination of tensile strength
- ENV 658-2      Advanced technical ceramics - Composite ceramics - Mechanical properties at room temperature - Part 2: Determination of compressive strength
- ENV 658-3      Advanced technical ceramics - Composite ceramics - Mechanical properties at room temperature - Part 3: Determination of flexural strength
- ENV 658-6      Advanced technical ceramics - Composite ceramics - Mechanical properties at room temperature - Part 5: Determination of shear strength by short-span three-point bend tests
- ENV 820-1      Advanced technical ceramics - Monolithic ceramics - Thermomechanical properties - Part 1: Determination of flexural strength at elevated temperatures
- ENV 820-2      Advanced technical ceramics - Monolithic ceramics - Thermomechanical properties - Part 2: Determination of self-loaded deformation
- ENV 820-3      Advanced technical ceramics - Monolithic ceramics - Thermomechanical properties - Part 3: Water quench thermal shock tests
- EN 821-1      Advanced technical ceramics - Monolithic ceramics - Thermophysical properties - Part 1: Determination of thermal expansion
- EN 821-2      Advanced technical ceramics - Monolithic ceramics - Thermophysical properties - Part 2: Determination of thermal diffusivity

- ENV 821-3 Advanced technical ceramics - Monolithic ceramics - Thermophysical properties - Part 3: Determination of specific heat
- EN 843-1 Advanced technical ceramics - Monolithic ceramics - Mechanical properties at room temperature - Part 1: Determination of flexural strength
- ENV 843-2 Advanced technical ceramics - Monolithic ceramics - Mechanical properties at room temperature - Part 2: Determination of elastic moduli
- ENV 843-4 Advanced technical ceramics - Monolithic ceramics - Mechanical properties at room temperature - Part 4: Determination of hardness
- ENV 1007-3 Advanced technical ceramics - Composite ceramics - Reinforcements - Part 3: Determination of filament diameter
- ENV 1007-4 Advanced technical ceramics - Composite ceramics - Reinforcements - Part 4: Determination of filament strength
- ENV 1071-3 Advanced technical ceramics - ceramic coatings - General properties - Part 3: Determination of coating thickness
- ENV 1071-5 Advanced technical ceramics - Ceramic coatings - General properties - Part 5: characterisation of microstructure
- ENV 1159-1 Advanced technical ceramics - Composite ceramics - Thermophysical properties - Part 1: Determination of thermal expansion
- ENV 1159-2 Advanced technical ceramics - Composite ceramics - Thermophysical properties - Part 2: Determination of thermal diffusivity
- ENV 1159-3 Advanced technical ceramics - Composite ceramics - Thermophysical properties - Part 3: Determination of specific heat
- ENV 1389 Advanced technical ceramics - Ceramic composites - Physical properties - Determination of density and apparent porosity
- IEC 672-2 Specification for ceramic and glass insulating materials - Part 2: Methods of test
- IEC 672-3 Specification for ceramic and glass insulating materials - Part 3: Individual materials



### 3 Definitions

For the purposes of this prestandard, the following definitions apply :

**3.1 advanced technical ceramic:** A highly engineered, high performance, predominantly non-metallic, inorganic, ceramic material having specific functional attributes.

NOTE : Other terms which in whole or in part cover the scope the above expression are in common use. The above term is the preferred in all circumstances.

**3.2 classification field:** A set of categories related to one independent aspect or feature of the classification.

**3.3 classification element:** A single category in a classification field.

**3.4 code:** An alphanumeric string with a prescribed definition in terms of material attributes.

**3.5 coding element:** A part of the alphanumeric code from one classification field.

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### 4 Objectives

This standard provides a framework whereby advanced technical ceramic products and materials can be classified for a variety of purposes including commercial statistics, market surveys, materials identification, coding and data bases.

The present range of products that is encompassed by the term "advanced technical ceramics" or one of its synonyms is enormous in breadth, and complex in chemical character, form and property attributes. Normally there are close interlinks between these factors. It has therefore been impossible to devise a single hierarchical scheme, such as that used in IEC 672 for electrotechnical ceramics for insulators or that in the Harmonised Commodity Description and Coding System for goods or derivatives thereof. The scheme developed and incorporated in this standard is novel in many respects to encompass all foreseen requirements and purposes, and all raw and manufactured materials and applications, i.e. it has great flexibility.

For these purposes, an adequate classification of the diversity of materials and products in various stages of manufacture may require the linking of chemical composition, form, material properties and applications in any required combination. The scheme described in this standard has the capability of classifying advanced technical ceramics by any combination of these fields in any sequence for any desired purpose. The fields are described individually in the following sections. Annexes B, C and D provide a coding scheme for each classification field of the scheme.

The user should select from the classification fields those relevant to his requirement, and to place these in a prescribed order. Some possible combinations are described in 6.

## 5 Individual classification fields

### 5.1 Introduction

Since the intention is to provide a capability for classifying any combination of fields in any sequence appropriate to user needs, each field is separately identified by a unique initial letter code:

- A = application
- C = chemical character
- D = property characteristic or data

The form of the product is closely related to chemistry, and is incorporated in the chemistry code. If appropriate, additional classification fields may be added in the same way. In each case these should be identifiable in a coding string by a unique initial letter code.

For the purposes of computer recognition, a strict sequence of classification elements is not required, but for other purposes, such as manual preparation of trade statistics or material specification, the sequence of classification elements should be chosen and fixed as preferred.

In the following description of code structures, the variable characters in the code are used:

- X = any appropriate single capital letter coding character
- n = any appropriate single numeric coding character

### 5.2 Classification field for application type

The initial character to denote the start of the "application" string is "A". This is followed by a three-digit number code as listed in Annex B for the application areas. In the list, applications are separated into, initially, a hierarchical series of areas by the principal functions of the product as defined by:

- **electrical insulation;**
- **electronic/ionic conduction;**
- **mechanical functions, including wear, at or near ambient temperature;**
- **thermal and thermomechanical functions, where dimensional stability at raised temperature, heat insulation, heat conduction or resistance to thermal shock are the principal functions, and where additionally mechanical loads may be applied;**
- **nuclear functions, where the component plays either an active or a passive nuclear role;**

- **optical functions**, where the component plays a functional role as an optical element in reflection, refraction, transmission or absorption of electromagnetic radiation;
- **chemical functions**, including biomedical, where the component is employed for handling melts, chemicals, solutions or atmospheres because of its resistance to attack by them, and in the case of biomedical materials, a degree of bio-compatibility.
- **magnetic functions**, where the component possesses properties allowing a functional magnetic role;

The first digit of the three-digit code is given as above by the principal physical function. The subsequent digits are non-hierarchical, and follow the listing in Annex B. To aid the identification of codes, an alphabetical index is also given. Figure 1 shows a flow diagram for the selection of application codes.

NOTE : It may not always be possible to assign a particular product to one of the listed codes. In such a case, the code representing "**Other functions**" should be employed, either within each of the above areas as appropriate, or failing this under code 950.

**EXAMPLES:**

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Resistor cores -

code A144

Wear resisting pads for slideways -

code A326

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[5e3f8af8085/sist-env-12212-2000](https://standards.iteh.ai/catalog/standards/sist/6aee2bc4-131a-4787-a4ee-5e3f8af8085/sist-env-12212-2000)

Rubber dipping formers -

code A820

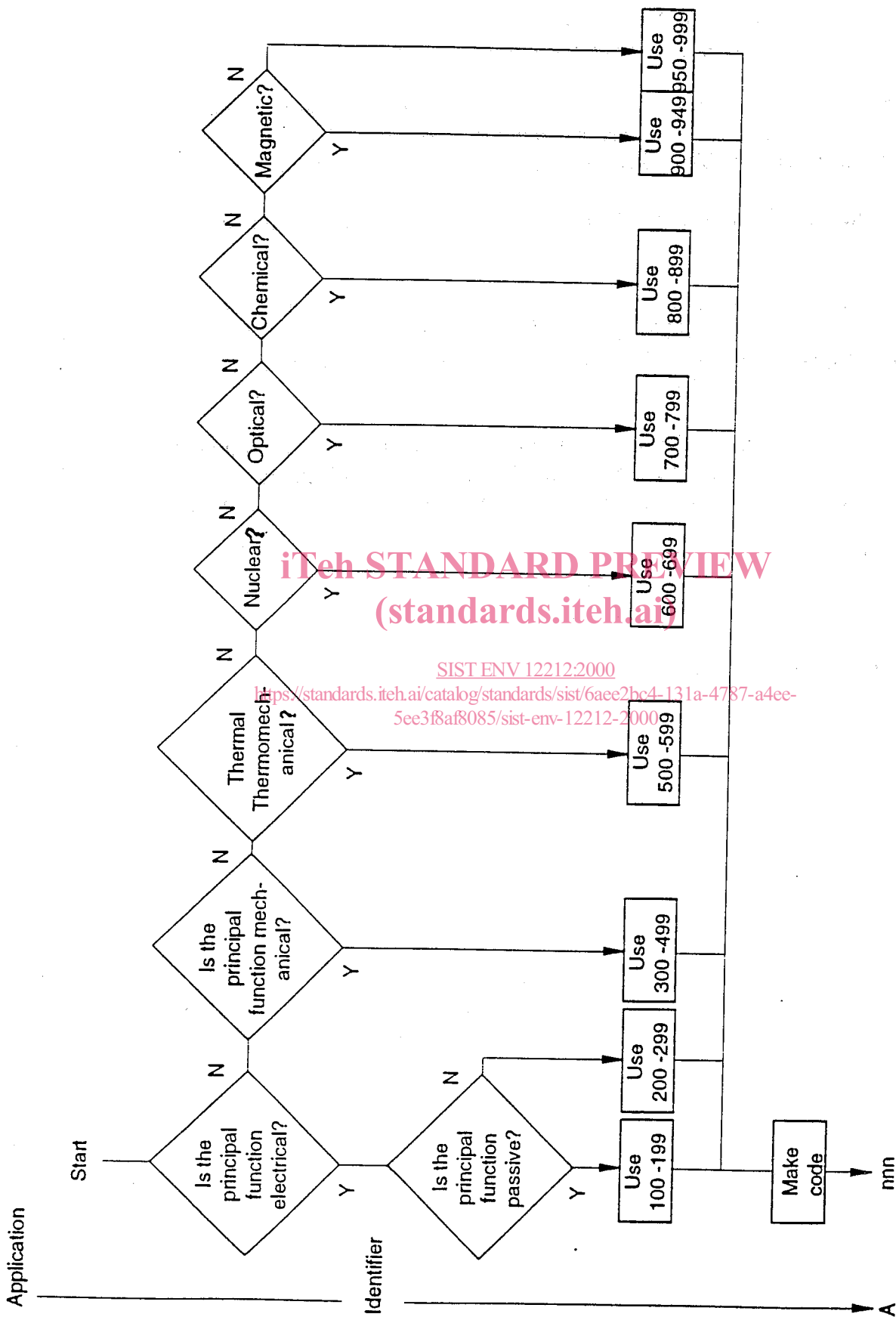


Figure 1: Flow diagram showing the selection of codes for Application.

### 5.3 Classification field for chemical character

**5.3.1** The initial identifier indicating "chemical character" is "C". Because the chemical character of advanced technical ceramics can be complex, a flexible method of classification has been devised. The one or two alphabetical characters that follow the initial "C" indicate the form in which the chemical species exists (precursor, powder, solid ceramic, etc.). The following alphanumeric string indicates the species and, optionally, the amount of it present, the relationship of a second species to the first (e.g. physical or chemical admixture), etc. Details of the categories, their code letters and their uses are given in Annex C.

Two forms of this string are given:

- a **short form** of code intended for broad description of chemical character of common types of powders or ceramic materials; and
- a **long form** when more detailed chemical information is required, such as the individual chemical components present, and the mass fraction present.

It is envisaged that the short form of code will be the most commonly used for commercial purposes, such as trade statistics or product designation. The long form of code is principally intended for use in inventory and data banking activities.

**5.3.2** The **short form** of code is a four-digit number (nnnn) in the range 5001 to 9999 found in Annex C. This is appended directly without punctuation to the chemical character identifier (C) and the form identifier (XX) to form a code:

CXXnnnn

This code is used with the appropriate form identifiers for all types of ceramic precursor and product.

#### EXAMPLES:

- |  |           |
|--|-----------|
| Dense high-alumina ceramic, 95% alumina  | - CKB5040 |
| Open porous calcium aluminosilicate ceramic (anorthite,<br>e.g. metallurgical filter material) | - CKG5555 |
| Separated and floated whiskers of alpha silicon carbide  | - CWE6250 |
| An open porous 2D woven silicon carbide fibre reinforced silicon carbide                       | - CKT6329 |

**5.3.3 The long form** of code is constructed as shown in Table 1. Chemical species codes are selected from code numbers 0001 to 4999 given in Annex C. The sequence of "form" plus "chemical code" plus "amount" string may be repeated as few or as many times as is required to define the product in the detail required.

Important aspects to note are:

- 1) The code may be developed in the detail required to classify the product for the objective in mind.
- 2) Compositional detail may be appended if appropriate to end-use requirements. For a ceramic product within a defined compositional range or a defined type, a special single code may be used (the short-form code - see above).
- 3) The minimum classification long-form code is "form" plus one identified chemical compound; all information beyond this point is non-mandatory.
- 4) The classification code is terminated either by no further characters, or by one of the initial characters A or D (or additional defined initial classification field codes) indicating the start of another classification field.

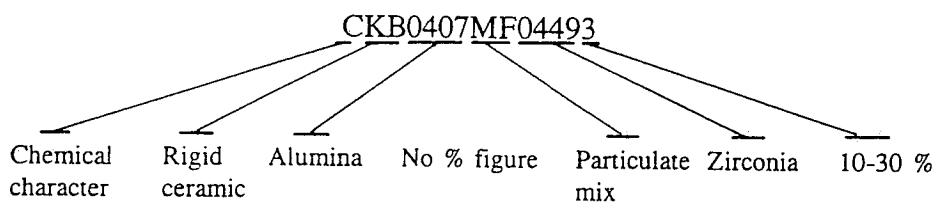
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A flow diagram indicating the decision route to the identification and selection of codes is shown in Figure 1. The following examples indicate the flexibility of use of the classification code in any appropriate way, while remaining uniquely machine readable.

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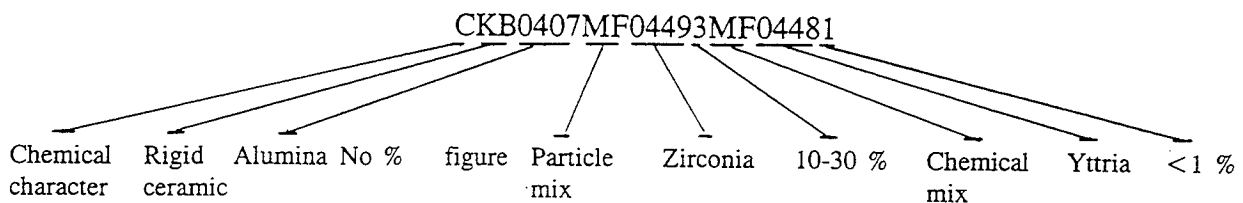
**EXAMPLE 1:**

Alumina ceramic with 15% by weight of unstabilized zirconia as a separate phase -

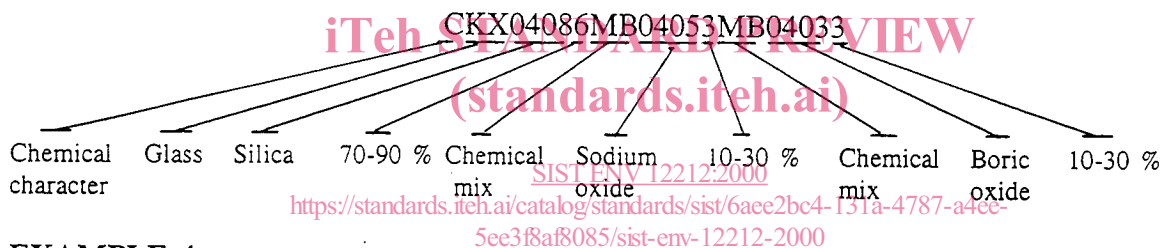


**EXAMPLE 2:**

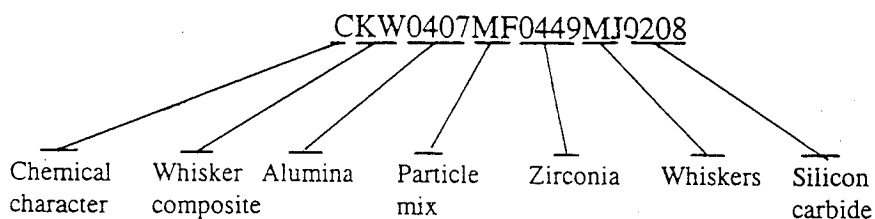
Alumina ceramic with 15% by weight of yttria stabilized zirconia as separate phase, yttria content in the zirconia not defined but less than 1% by weight overall -

**EXAMPLE 3:**

Sodium borosilicate glass of defined composition 71% SiO<sub>2</sub>, 12% Na<sub>2</sub>O, 17% B<sub>2</sub>O<sub>3</sub> -

**EXAMPLE 4:**

Silicon carbide whisker-reinforced alumina/unstabilized zirconia with unspecified composition:



or for this particular case with unspecified percentages, the short form CKW5190 could be used with equal value.

NOTE: It may not always be possible to assign a particular product to one of the listed codes. In such a case, the code or codes representing "Other" chemical species should be used, either within a chemical group for the long-form code (e.g. "Other chromites" (2119)) or within a generic ceramic type for the short-form code (e.g. "Other glass-ceramics" (9999)).