

Advanced technical ceramics — Unified method for classification

ICS 81.060.20

Committees responsible for this Draft for Development

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AEA Technology
Aluminium Federation
British Ceramic Research Ltd.
British Industrial Ceramic Manufacturers' Association
Department of Trade and Industry (National Physical Laboratory)
Flat Glass Manufacturers' Association
GAMBICA (BEAMA Ltd.)
Institute of Refractories Engineers
Ministry of Defence
Refractories Association of Great Britain
Society of British Aerospace Companies Ltd.
University of Manchester

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National foreword

This Draft for Development has been prepared by Technical Committee RPI/13 and is the English language version of ENV 12212 : 1995 *Advanced technical ceramics — Unified method for classification* published by the European Committee for Standardization (CEN).

This publication is not to be regarded as a British Standard

It is being issued in the Draft for Development series of publications and is of a provisional nature because it is considered that further experience is required in its application before it is converted into a British Standard. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

A review of this prestandard will be carried out 2 years after its publication.

Submission of comments from users of this publication is requested.

According to the replies received, the responsible BSI committee will judge whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it.

Comments should be sent in writing to the Secretary of BSI Technical Committee RPI/13, 389 Chiswick High Road, London W4 4AL, quoting the document reference (DD ENV 12212), the relevant clause and proposing, where possible, an appropriate revision of the text.

NOTE. International and European Standards as well as overseas standards, are available from Customer Services, BSI, 389 Chiswick High Road, London, W4 4AL.

Cross-references

Publication referred to	Corresponding British Standard
EN 623-2 : 1993	BS EN 623 <i>Advanced technical ceramics — Monolithic ceramics — General and textural properties</i> Part 2 : 1993 <i>Determination of density and porosity</i> DD ENV 623 <i>Advanced technical ceramics — General and textural properties</i>
ENV 623-3 : 1993	Part 3 : 1993 <i>Determination of grain size</i>
ENV 623-4 : 1993	Part 4 : 1994 <i>Determination of surface roughness</i> DD ENV 658 <i>Advanced technical ceramics — Mechanical properties of ceramic composites at room temperature —</i>
ENV 658-1 : 1993	Part 1 : 1993 <i>Determination of tensile strength</i>
ENV 658-2 : 1993	Part 2 : 1993 <i>Determination of compressive strength</i>
ENV 658-3 : 1992	Part 3 : 1993 <i>Determination of flexural strength</i>
ENV 658-6 : 1993	Part 6 : 1993 <i>Determination of shear strength by double-punch shearing</i> DD ENV 820 <i>Advanced technical ceramics — Methods of testing monolithic ceramics — thermomechanical properties —</i>
ENV 820-1 : 1993	Part 1 : 1994 <i>Determination of flexural strength at elevated temperatures</i>
ENV 820-2 : 1992	Part 2 : 1994 <i>Determination of self-loaded deformation</i>
ENV 820-3 : 1993	Part 3 : 1994 <i>Determination of resistance to thermal shock by water quenching</i>
EN 821-1 : 1995	BS EN 821 <i>Advanced technical ceramics — Monolithic ceramics — Thermophysical properties</i> Part 1 : 1995 <i>Determination of thermal expansion</i>
ENV 821-3 : 1993	DD ENV 821 <i>Advanced technical ceramics — Monolithic ceramics — Thermophysical properties</i> Part 3 : 1994 <i>Determination of specific heat capacity</i>

ENV 843-1 : 1994 ¹⁾	DD ENV 843 <i>Advanced technical ceramics — Monolithic ceramics — Mechanical properties at room temperature</i>
ENV 843-4 : 1994	Part 1 : 1995 ²⁾ <i>Determination of flexural strength</i>
	Part 4 : 1995 <i>Vickers, Knoop and Rockwell superficial hardness tests</i>
	DD ENV 1007 <i>Advanced technical ceramics — Ceramic composites — Methods of test for reinforcements</i>
ENV 1007-3 : 1993	Part 3 : 1994 <i>Determination of filament diameter</i>
ENV 1007-4 : 1994	Part 4 : 1994 <i>Determination of tensile properties of filament at ambient temperature</i>
	DD ENV 1071 <i>Advanced technical ceramics — Methods of test for ceramic coatings</i>
ENV 1071-3 : 1994	Part 3 : 1994 <i>Determination of adhesion by a scratch test</i>
ENV 1071-5 : 1995	Part 5 : 1995 <i>Determination of porosity</i>
	DD ENV 1159 <i>Advanced technical ceramics — Ceramic composites — Thermophysical properties</i>
ENV 1159-1 : 1993	Part 1 : 1994 <i>Determination of thermal expansion</i>
ENV 1159-2 : 1993	Part 2 : 1994 <i>Determination of thermal diffusivity</i>
ENV 1159-3 : 1995	Part 3 : 1995 <i>Determination of specific heat capacity</i>
ENV 1389 : 1994	DD ENV 1389 : 1994 <i>Advanced technical ceramics — Ceramic composites — Physical properties — Determination of density and apparent porosity</i>

The Technical Committee has reviewed the provisions of IEC 672-2 and IEC 672-3 to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this Draft for Development.

IEC 627-2 and IEC 627-3 are being revised and will be published as BS EN 60672-2 and BS EN 60672-3.

¹⁾ Superseded by EN 843-1 : 1995.

²⁾ Superseded by BS EN 843-1 : 1995.

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Descriptors: Composite materials, ceramics, technical ceramics, classifications

English version

Advanced technical ceramics — Unified method for classification

Céramiques techniques avancées — Méthode
unifiée de classification

Hochleistungskeramik — Einheitliches
Verfahren zur Klassifizierung

This European Prestandard (ENV) was approved by CEN on 1992-12-31 as a prospective standard for provisional application. The period of validity of this ENV 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 ENV can be converted into a European Standard (EN).

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

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Prestandard has been prepared by the Technical Committee 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 Regulations, 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.

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:

Resistor cores -	code A144
Wear resisting pads for slideways -	code A326
Rubber dipping formers -	code A820

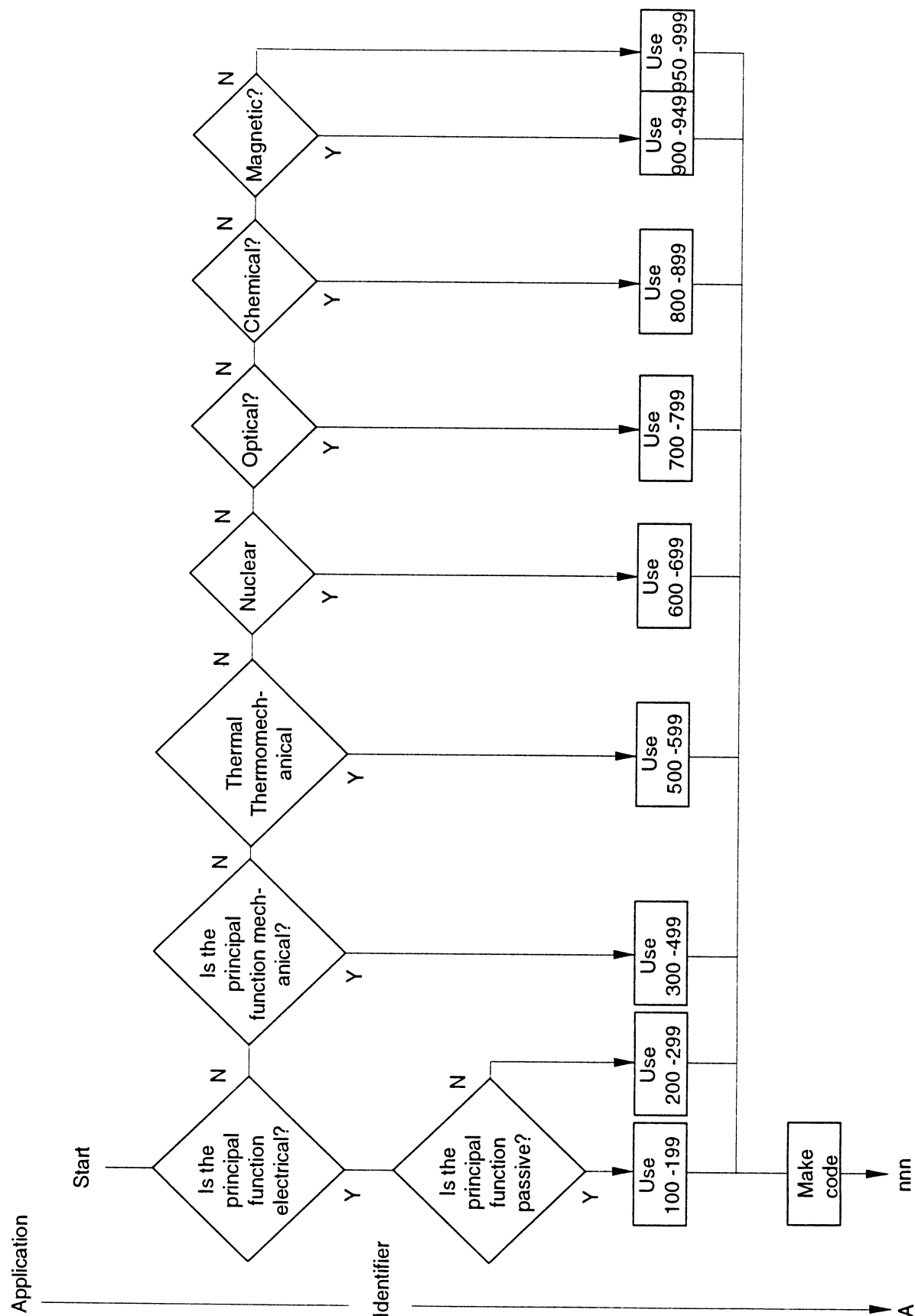


Figure 1: Flow diagram showing the selection of codes for Application.

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, 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.

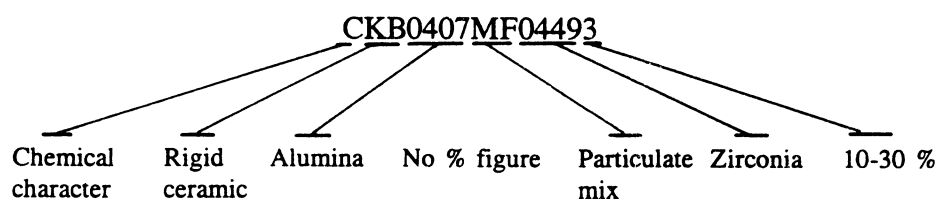
Important aspects to note are:

- 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.

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.

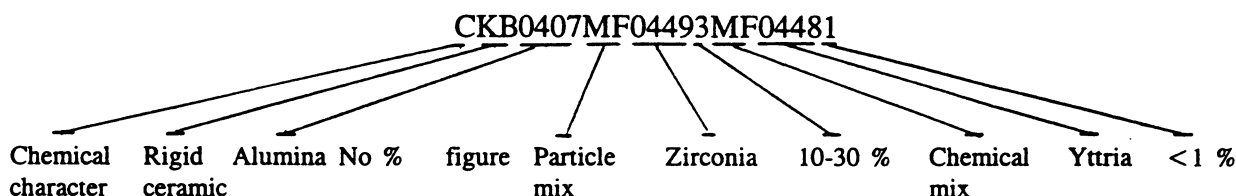
EXAMPLE 1:

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



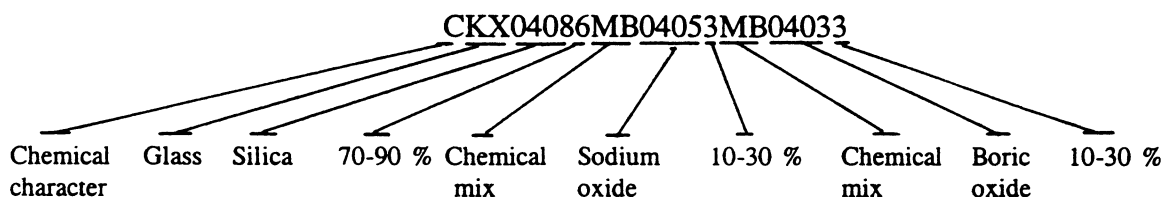
EXAMPLE 2:

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 -



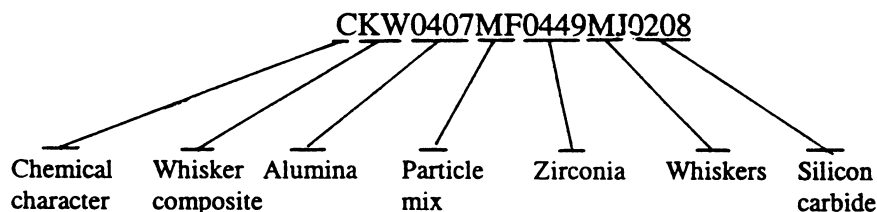
EXAMPLE 3:

Sodium borosilicate glass of defined composition 71% SiO₂, 12% Na₂O, 17% B₂O₃ -



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)).

Table 1 - Construction of the long-form chemical character code

Code element	Description
C	Chemical character code string identifier
XX	One or two-letter code indicating the overall "form" of the product
nnnn	Four digit chemical character code from the numerical range 0001 to 4999 (see Annex C)
n	Optional coding element for indicating "amount" of the species nnnn in the product expressed as mass percentage, according to the following code: 1 ≤ 1% 2 > 1%, ≤ 10% 3 > 10%, ≤ 30% 4 > 30%, ≤ 50% 5 > 50%, ≤ 70% 6 > 70%, ≤ 90% 7 > 90%, ≤ 99% 8 > 99% If the value is undefined or undefinable, this character is omitted.
XX (**)	Two letters indicating how a second species is mixed in relation to the first when in the same form of product, e.g. for a specified second component in a two-species powder or ceramic, or an impurity.
nnnn	Four digit chemical character code for the second species.
n	Optional single digit coding percentage by mass of second species.
(**)	The sequence is repeated from (**) for third and subsequent species as necessary.

Chemistry

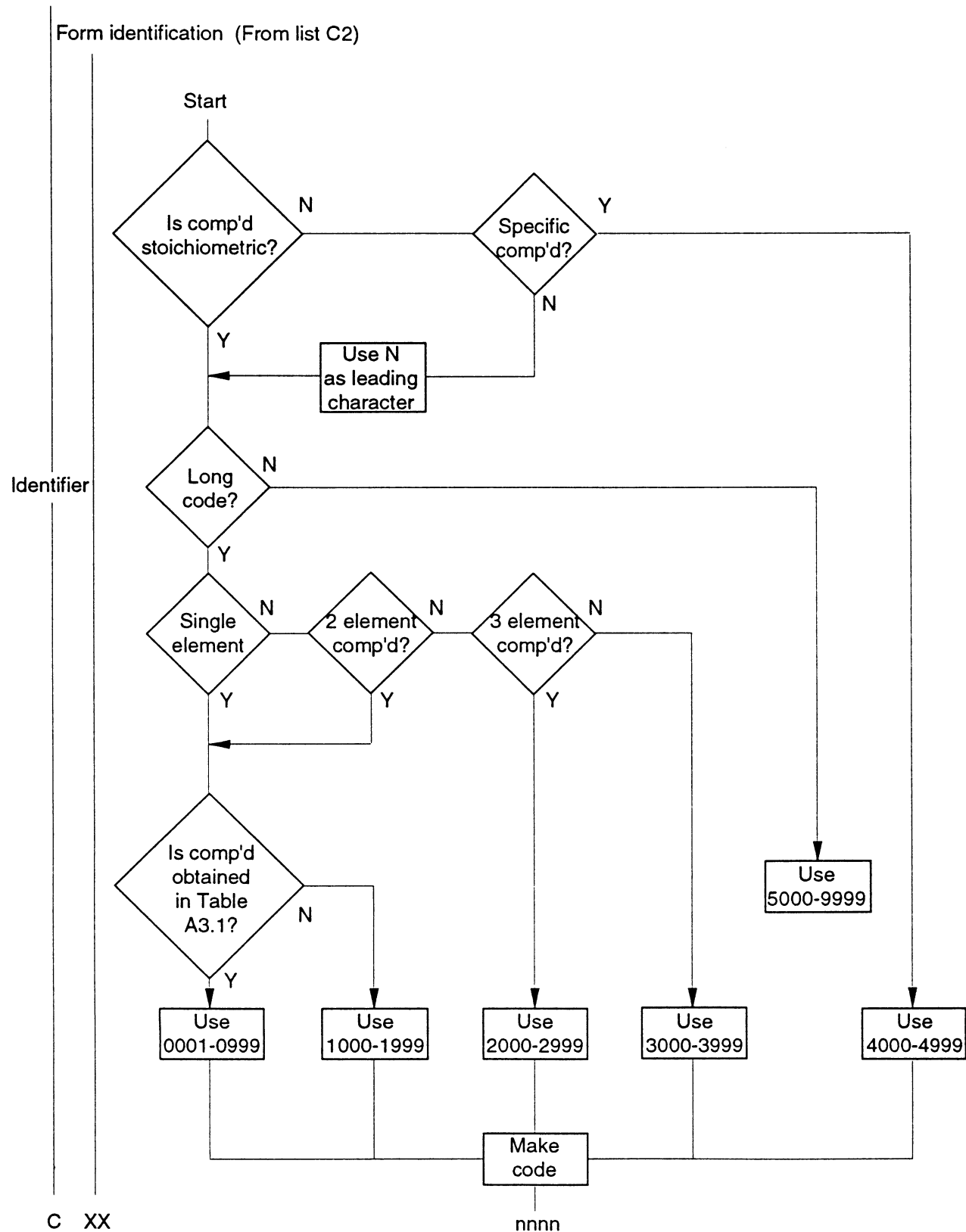


Figure 2: Flow diagram for selection of codes representing chemical character.

5.4 Classification field for property characteristics or data

5.4.1 Many ceramic products are developed for specific property attributes appropriate to particular end uses. If it is required to provide a classification element to define the "properties" or "characteristics", this is done using a code with an initial letter "D" (data), followed by a string of 3 to 6 numerical characters defined according to the matrix in Annex D. The first numerical character defines the property class, and the second the property type within that class. Where appropriate, details of the properties are coded in subsequent numerical characters.

A flow diagram for the selection of property data codes is shown in Figure 3.

5.4.2 For cases in which one or more properties are seen to be of relevance in the classification of a ceramic product, but where it is **either**

- 1) adequate to indicate simply this fact, or
- 2) where it is not possible to ascribe a numerical value because there are no standardised procedures for giving single-valued data, or
- 3) there are no standardised test methods

the code is limited to the first three numerical characters. The citing of such property characteristics shall be taken to imply that the property is important for the function of the material, either by design of the material or by the application for which it is intended.

EXAMPLES:

An acid-resistant material	- D802
An electrooptic material	- D617
A material designed for (unspecified) thermal shock resistance	- D303

5.4.3 Where it is appropriate to employ **numerical property values**, properties are divided into numerical bands of values as determined by a specified test method. The appropriate band can be selected using the fourth numerical character. When desirable or appropriate, the property band may be qualified by use of a fifth numerical character indicating the temperature range in which the property has a value in the selected band. With particular reference to electrical properties, a sixth numerical character may be selected to indicate the frequency range relevant to the property data. The frequency character shall always be used in conjunction with the temperature character to avoid ambiguity.

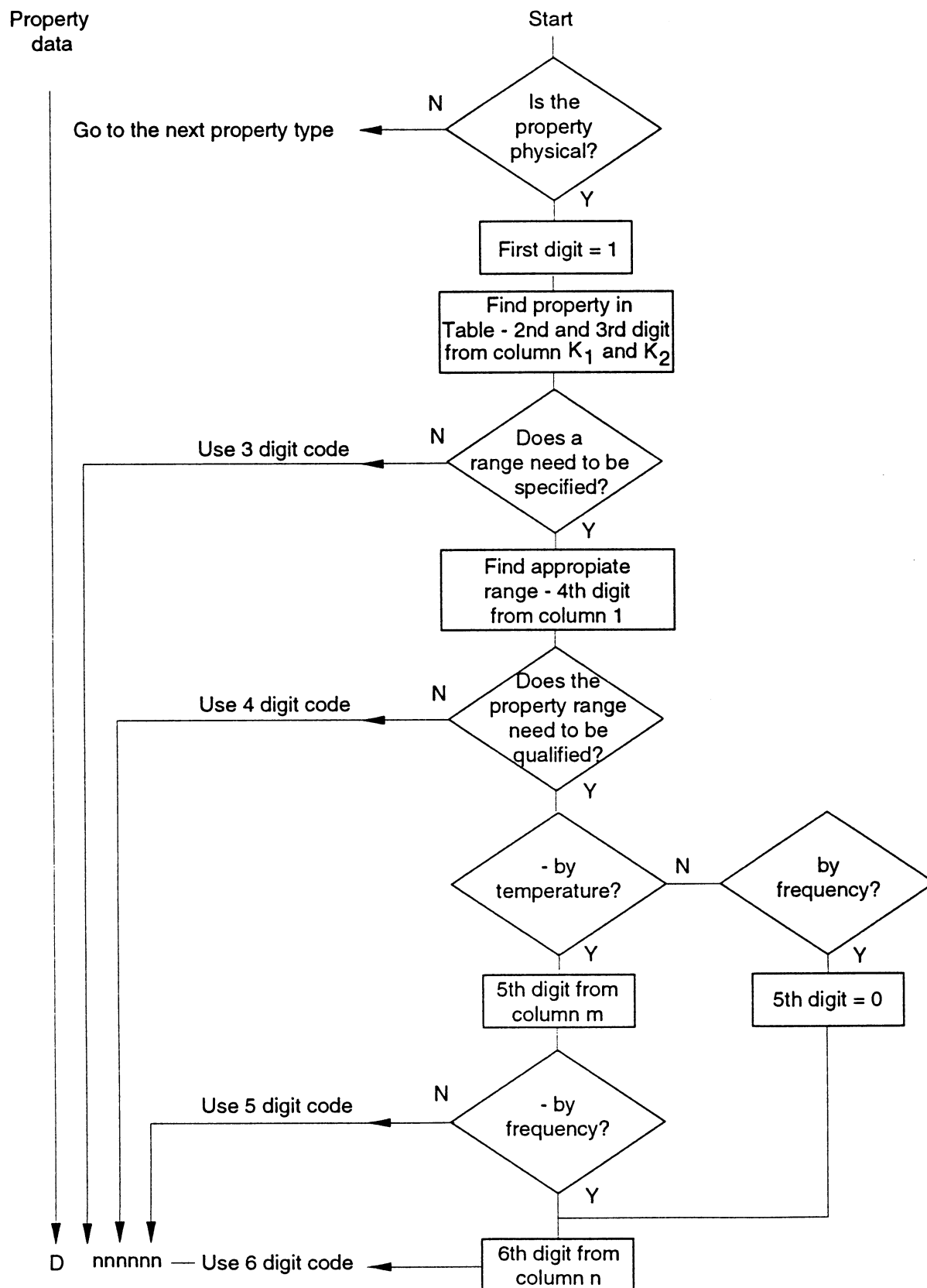
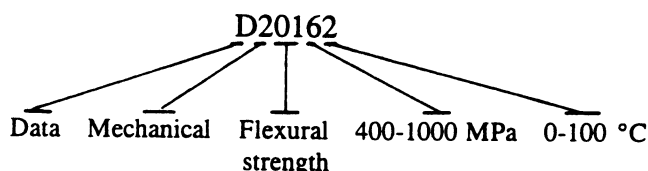


Figure 3: Flow diagram for the selection of codes representing data.

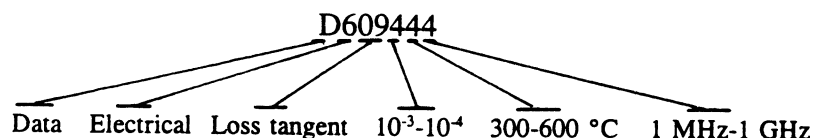
EXAMPLE 1:

A material with room-temperature flexural strength of 600 MPa :



EXAMPLE 2:

An electrical insulator with loss tangent 5×10^{-4} at 400 °C and 10 MHz:



5.4.4 If more than one property characteristic is required, the code D is repeated, i.e.

DnnnDnnnnnnDnnn

represents three property features of particular relevance. These coding elements can be placed in any sequence without change of meaning.

NOTE: It is envisaged that property classification elements could be expanded into a more-detailed data base when this is desired, the other classification elements being employed to define uniquely the chemical character, applications, and any other feature of the material or component.

EXAMPLE:

A material with thermal conductivity $40 \text{ W m}^{-1} \text{ K}^{-1}$, dielectric loss 5×10^{-4} at 10 MHz and flexural strength 600 MPa , all at 400 °C:

D20164D609444D30154

The first two elements in this example are taken from the previous examples for single elements, and the third signifies the thermal conductivity.

5.5 Other classification fields

While not a recommended part of this standard, additional classification fields may be employed for further features associated with a product as required by the application of the classification. If it is desired to include such information, the classification fields should be constructed as agreed tables of codes in the form:

Xnnn

where X is a unique and unambiguously identifiable initial classification field character, and nnn is a three digit code from an agreed table. In this form, the additional classification elements remain unique and machine readable.

6 Construction of a complete classification code

The classification method described above may be used to assemble a code to any length to any level of detail appropriate to the end-use requirements. By using unique letter identifiers at the start of each classification element an individual element is easily identifiable in the combined code, which can then be constructed in any appropriate order of classification fields.

The complete code comprises the individual coding elements in any agreed order, and should be written as a continuous string of characters with no gaps or punctuation.

It is the purpose of this standard to provide only a framework for classification rather than to prescribe exact forms of codes for specific end functions. The system is sufficiently flexible to cover many envisaged purposes by the appropriate agreed methods of selecting and ordering the coding elements. However, it is recommended that unless otherwise required, the short form of chemistry code is employed.

The following examples are given to illustrate the potential applications.

EXAMPLE 1:

To survey markets or to compile trade statistics for advanced technical ceramics, a trade organisation might require compilation of sales data by its members by classifying their products according to the criterion:

application + short-form chemical character

The classification code would appear as:

AnnnCXXnnnn

where XX defines the form of the product of interest, and nnnn is a short form code for a particular chemistry category. Trade returns could be asked for labelled in this way. Thus reduced titania threadguides would be coded:

A402CKB6441