

Specification for

Dental porcelains for jacket crowns

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- British Ceramic Research Association
- British Institute of Surgical Technicians
- British Society for the Study of Orthodontics
- British Steel Corporation
- Dental Laboratories' Association Limited
- General Dental Practitioners' Association
- Institute of Metallurgists
- London Dental Study Club

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Foreword

This British Standard was prepared under the direction of the Dental Standards Committee.

Dental porcelain presents particular difficulties in testing because its properties are probably more dependent on the expertise and handling technique used than those of any other dental material. An extensive and detailed research programme undertaken by the British Ceramic Research Association, under the auspices of the Department of Industry, provided much of the technical data on which the specification was prepared.

Because the testing of dental porcelains for standards purposes is a completely new field, particular attention has been paid to the details and overall coverage of this specification. The adequacy of, and need for, such details will be kept under review, and if experience, backed by technical data, indicates the need for amendment, this will be considered by the responsible BSI committee.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies the characteristics of dental porcelains used for jacket crown restorations made entirely of porcelain.

The standard specifies limits and methods of test for mechanical, thermal, optical and other general properties of the materials.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1

aluminous porcelains

dental porcelains significantly strengthened by the addition of crystalline α -alumina

3.2

condensation

any process by which the apparent powder density (as defined in BS 2955) of unfired dental porcelain is intentionally increased

3.3

core porcelains

opaque dental porcelains that provide a mechanically strong, optically uniform basis for a jacket crown restoration

3.4

dental porcelains

ceramic materials that may be fabricated into shapes simulating the form and function of a natural tooth

3.5

dentine/body porcelains

translucent, pigmented dental porcelains used to give the overall shape and colour to a jacket crown restoration

3.6

degrees of fusion

- a) High biscuit: the state achieved when firing shrinkage is just complete.
- b) Medium glaze: the state of glaze that is clinically and aesthetically acceptable.

3.7

enamel porcelains

translucent, lightly pigmented dental porcelains used as an outer covering of a jacket crown restoration to simulate the translucency of natural teeth

3.8

modelling fluid

a liquid, other than water, with which a dental porcelain may be mixed prior to condensation

3.9

pyroplasticity

plastic deformation by gravitational and/or surface tension forces at elevated temperatures

3.10

vacuum firing porcelain

a dental porcelain intended to be fired at a reduced pressure

4 Classification

Dental porcelains may be classified as follows:

- a) vacuum (reduced pressure) firing or air (atmospheric pressure) firing porcelains;
- b) aluminous or non-aluminous porcelains;
- c) core-, dentine/body- or enamel-porcelains;
- d) according to fusion range:

Low-fusing	800 °C to 1 050 °C
Medium-fusing	1 050 °C to 1 200 °C
High-fusing	1 200 °C to 1 400 °C

5 Requirements

5.1 Powder. The dental porcelain shall be supplied as a powder free from extraneous matter.

The powder shall be of such a composition that no adverse chemical reactions occur during the production of a jacket crown restoration that has been made according to the manufacturer's instructions.

5.1.1 Types and their identification. Dental porcelains shall be divided into types according to their intended use and, if a colour coding system is used to identify the type of powder, the appropriate colour given below shall be used.

Type	Colour
Core porcelains	Yellow or none
Dentine/body porcelains	Pink
Enamel porcelains	Blue
Neck material	Green
Transparent material	None
Concentrate material	None
Add-on material	None
Glaze material	None

Colour coding shall not involve the addition to the powder of more than 0.01 % (m/m) of organic material.

5.1.2 Pigments, dyes and fluorescing agents. Both the metal oxide pigments used to obtain the fired colour of dental porcelain and the dyes used for identification shall be uniformly dispersed throughout the dental porcelain powder. No segregation of the pigments or separation of the dyes from the porcelain shall take place when it is mixed in accordance with 8.1.

Deliberate additions of radioactive substances for the purpose of producing fluorescence shall not be made to dental porcelains manufactured after 30 June 1978.

5.1.3 Particle size. The particle size shall be such that, when the powder is tested in the manner described in 8.2, not more than 0.5 % (*m/m*) is retained on a 75 µm test sieve and not more than 5.0 % (*m/m*) is retained on a 53 µm test sieve. Test sieves that comply with the requirements of BS 410 shall be used.

5.2 Dental porcelain paste. When mixed in the correct proportion with water or a suitable modelling fluid, the dental porcelain powder shall not form lumps or granules.

The paste formed shall be suitable for the hand-building of a jacket crown restoration by conventional dental laboratory techniques.

5.3 Condensed porcelain. The condensed dental porcelain powder shall not crack or crumble during the drying cycle recommended by the manufacturer.

5.4 Freedom from irritants or toxic ingredients. The dental porcelain shall not contain ingredients in sufficient concentration to cause prolonged local irritation or any systemic toxic reaction when used in accordance with the manufacturer's instructions.

5.5 Physical and chemical properties. Specimens prepared and tested in accordance with the relevant methods in clause 8 shall comply with the requirements specified in Table 1.

5.6 Resistance to staining. When tested as described in 8.12, the "as fired" outer surfaces of the specimens, and the fractured, glazed or ground surfaces shall show no visible staining.

5.7 Manufacturer's instructions. The instructions supplied by the manufacturer shall include the following information:

- a) a time-temperature cycle for drying the condensed porcelain powder;
- b) a time-temperature cycle for the firing schedule including the rate of heating, the final temperature (in °C/min) and the time it should be held;
- c) the glazing temperature;
- d) if applicable, the level and duration of vacuum;

- e) details of the coefficient of linear expansion and upper transformation temperature (as defined in BS 3447) under the conditions of test detailed in 8.6.

6 Sampling

The following samples shall be obtained.

- a) Where there are four or more shades in a type of dental porcelain (see 5.1.2), take one 50 g sample of each shade.
- b) Where there are two or three shades of a type of dental porcelain, take two 50 g samples of each shade.
- c) Where there is only one shade of a type of dental porcelain, take three 50 g samples.

Sufficient quantities of essential modelling fluids should be obtained, if their use is recommended by the manufacturer.

If the shades of a type of porcelain comply with the requirements 5.1, 5.2 and 5.3, form a "pool" of powder of that type by taking samples of equal mass from each shade using the grid type sample divider principle as described in BS 3406-1. The total mass of the pool of powder shall be 100 g.

7 Inspection

Visual inspection, without magnification, shall be used to determine compliance with the requirements specified in 5.1.1, 5.1.2, 5.1.3, 5.2 and 5.3.

8 Test methods

8.1 Preparation of test specimens

8.1.1 General. The apparatus described in 8.1.4 and 8.1.6, and the conditions of mixing, condensation and firing apply to all the test methods unless it is stated otherwise.

8.1.2 Ambient conditions. All mixing of the porcelain pastes in preparing test specimens and all testing shall be carried out at a temperature of 23 ± 2 °C. No special precautions need to be taken to control the humidity.

8.1.3 Components. Unless stated otherwise, tests shall be carried out on specimens prepared from the "pool" of powder specified in clause 6, with water or the modelling fluid recommended by the manufacturer.

NOTE 8.9, 8.10 and 8.11 require material of specific shades.

The powder shall be taken from the "pool" using the grid-type sample divider referred to in clause 6 and all water used in the test procedures shall comply with BS 3978.