INTERNATIONAL STANDARD

ISO 9333

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Dental brazing materials

Produits pour brasage à usage dentaire

Reference number
ISO 9333:1990(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9333 was prepared by Technical Committee ISO/TC 106, *Dentistry*.

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Introduction

Specific qualitative and quantitative requirements for freedom from biological hazard are not included in this International Standard but it is recommended that in assessing possible biological or toxicological hazards, reference should be made to ISO/TR 7405:1984, *Biological evaluation of dental materials*.

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Dental brazing materials

1 Scope

This International Standard specifies requirements and test methods for brazing materials suitable for use in brazing cast dental restorations.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6892:1984, *Metallic materials — Tensile testing.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 dental brazing material: Alloy suitable for use as a filler material in operations in which dental alloy(s) parts are joined to form a dental restoration.

3.2 flow temperature: Lowest temperature at which the filler material is fluid enough to flow into the gap and to wet the surface of the metallic parts.

4 Requirements

4.1 Chemical composition

The composition of the brazing material shall be within 0,5 % (*m*/*m*) of the value for each component stated by the manufacturer [see clause 7a)].

If the dental brazing material contains more than 0,1 % (*m*/*m*) of nickel and/or more than 0,02 % (*m*/*m*) of beryllium, cadmium and/or lead, the manufacturer shall clearly state this [see clause 7f)].

Testing shall be in accordance with standard analytical procedures of sufficient accuracy for the required values.

4.2 Biocompatibility

See Introduction for guidance on biocompatibility.

4.3 Corrosion resistance

A comparison of the surfaces of an untreated and a treated specimen shall not reveal any visible evidence that a chemical reaction has occurred.

Testing shall be in accordance with 6.3.

4.4 Tarnish resistance

A comparison of the surfaces of an untreated and a treated specimen shall not reveal any significant darkening or discolouration of the treated specimen surface.

Testing shall be in accordance with 6.4.

4.5 Mechanical strength of brazed joint (tensile strength)

The maximum stress of the specimen shall exceed 350 MPa[1)] or the 0,2 % proof stress of the weakest of the metallic parts.

Testing shall be in accordance with 6.5.

1) 1 MPa = 1 N/mm^2

4.6 Melting range

The solidus and the liquidus temperature of the brazing material shall be within ± 10 °C of the values given in the manufacturer's instructions [see clause 7b)].

Testing shall be in accordance with 6.6.

4.7 Flow temperature

The flow temperature of the brazing material shall be within ± 10 °C of the value given in the manufacturer's instructions [see clause 7c) and clause 9c)].

Testing shall be in accordance with 6.7.

4.8 Conditions before use

The brazing material shall be clean and uniform in colour.

5 Sampling

The amount of test material shall be sufficient for the preparation of two sets of three tensile specimens and of four specimens for corrosion and tarnish testing for each alloy or alloy combination to be joined.

The method of procurement of the brazing materials and the alloys needed for testing should be recorded in the test report.

6 Testing

6.1 Visual inspection

Visually inspect for compliance with the requirements specified in this International Standard.

6.2 Preparation of test specimens

6.2.1 General

The test specimens consist of the recommended alloys joined by the brazing material according to the manufacturer's instructions.

Prepare the test specimens of the alloy(s) by the "lost wax process" of investment casting and braze by means generally used in a dental laboratory. Follow the manufacturer's instructions relating to the processing of the alloy(s) and the brazing material as well as to the necessary aids, the casting and the brazing equipment.

6.2.2 Specimens for corrosion and tarnish testing

Cast four square specimens of dimensions 10 mm × 10 mm × 1 mm and clean the surfaces. Then cut the specimens in half (5 mm × 10 mm × 1 mm). Prepare two halves of the recommended dental alloy(s) for brazing. The gap between the cut pieces shall be between 0,1 mm and 0,2 mm unless the manufacturer's instructions direct otherwise. Use the recommended flux and follow the manufacturer's instructions on brazing.

For corrosion testing, polish and clean the specimens on both 10 mm × 10 mm surfaces according to common metallographic procedures.

For tarnish testing, cold-mount the specimens and then grind, polish and clean them according to common metallographic procedures.

6.2.3 Specimens for tensile testing

Prepare three specimens for testing according to figure 1 or figure 2.

It is suggested that the test specimens should be made out of a casting pattern as shown in figure 3. Separate the specimens from the sprues, clear them of beads, nodules, fins, etc. and sandblast them. No further finishing shall be carried out. Replace specimens with visible shrinkage defects or porosities.

Cut each of the test specimens at right-angles to its long axis at the midpoint of the gauge length using a fine saw and remove rough edges. Grind the cut surfaces smooth, plane and perpendicular to the axis of the test specimen. Support the two halves of the test specimen(s) and align them in an investment or a rigid jig. Separate the cut pieces by a gap of between 0,1 mm and 0,2 mm unless the manufacturer's instructions state otherwise. Use the recommended flux and follow the manufacturer's instructions on brazing.

After brazing, ensure that the diameter of each tensile specimen is within the tolerances given in figure 1 or figure 2, and does not show visual evidence of eccentricity when rotated.

Dimensions in millimetres

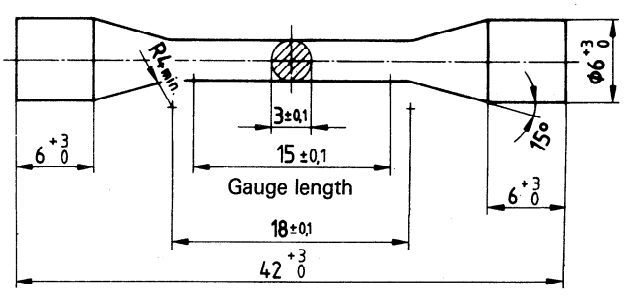


Figure 1 — Test specimen with cylindrical ends

Dimensions in millimetres

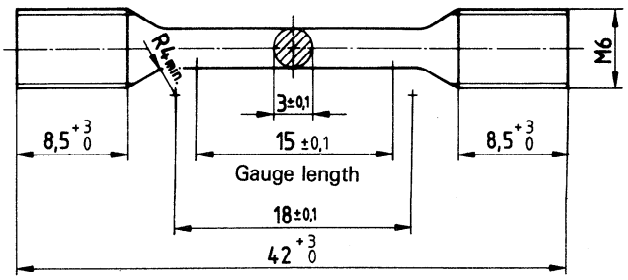
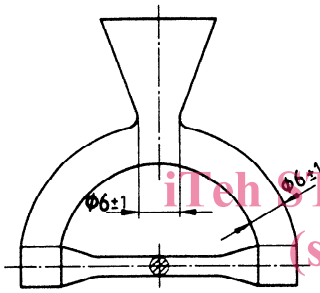


Figure 2 — Test specimen with threaded ends

Dimensions in millimetres



NOTE — The sprues can have the shape of a bow or a triangle or a "U".

Figure 3 — Test specimen with suggested sprues and sprue button

6.3 Corrosion resistance

After preparing the specimens for corrosion testing according to 6.2.2 treat one of them by suspending in a continuously aerated solution of 0,1 mol/l lactic acid *pro analysi*[2] and 0,1 mol/l sodium chloride *pro analysi*[2] for 7 days at (37 ± 1) °C. Then rinse the specimen with distilled water, clean it in 10 % ammonia solution, rinse it again in distilled water and dry it. Examine the surface of the treated and of the untreated specimen visually without magnification.

6.4 Tarnish resistance

Treat one of the mounted specimens which are prepared for tarnish testing according to 6.2.2 in a device which dips the specimen into a freshly made aqueous solution of 0,1 mol/l sodium sulfide *pro analysi*[2] for a period of 10 s to 15 s every minute at (23 ± 2) °C.

2) Equivalent analytical grade reagent.

After 72 h rinse and dry the specimen. Examine the surfaces of the treated and of the untreated specimen visually without magnification.

6.5 Tensile strength

Determine the maximum stress according to ISO 6892 on specimens prepared according to 6.2.3. Load the specimens in a tensile tester at a cross-head speed of (1,5 ± 0,5) mm/min up to the fracture point of the specimen.

Calculate the values on the basis of the original cross-sectional area to the nearest 5 MPa.

If more than one of the three specimens do not meet the requirement of 4.5, the brazing material fails the test for use with the alloy(s) combination against which it was tested.

If one of the three specimens does not meet the requirement of 4.5, test another three specimens. Determine the mean value of all six results for compliance with the required value.

6.6 Melting range

Determine the melting range by the cooling curve method or other methods of equivalent accuracy.

6.7 Flow temperature

Determine the flow temperature by using the following procedure.

Paint a piece of the dental brazing material weighing between 0,05 g and 0,15 g with the recommended [see clause 7d)] flux and place it in the middle of a foil of platinum or gold also painted with the recommended flux over an area of about 15 mm × 15 mm. Place this assembly in an electric furnace with a bare thermocouple in contact with the foil. Do not allow the initial furnace temperature to exceed 50 °C below the solidus temperature of this dental brazing material. Raise the furnace temperature at a rate of not more than 10 °C/min and note the temperature at which the dental brazing material flows over the foil.

7 Manufacturer's information and instructions

At least the following information and instructions shall be provided by the manufacturer or the distributor on a leaflet and/or package or label:

a) contents of all elements in the alloy greater than 1 % (*m*/*m*);

b) melting range in degrees Celsius;

c) flow temperature in degrees Celsius;

d) recommendation for fluxes and for alloys and/or alloy combinations;

e) exact brazing instructions for recommended alloys and/or alloy combinations;

f) if the dental brazing material contains more than 0,1 % (*m*/*m*) of nickel and/or more than 0,02 % (*m*/*m*) of beryllium, cadmium and/or lead a clear statement of this by the manufacturer and adequately detailed instructions regarding special precautions.

8 Packaging

The dental brazing material shall be packaged in accordance with accepted commercial practice to prevent any contamination or damage.

9 Marking

The packets shall be clearly marked at least with the following information:

a) manufacturer's name and/or trade-mark;

b) designation or trade-mark;

c) flow temperature;

d) serial number or combination of letters or numbers which refer to the manufacturer's record for this particular lot or batch;

e) minimum net mass, in grams;

f) if the dental brazing material contains more than 0,1 % (*m*/*m*) of nickel and/or more than 0,02 % (*m*/*m*) of beryllium, cadmium and/or lead a clearly visible warning on the package identifying by name the constituent(s) concerned and the amount(s) used.

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Descriptors: dentistry, dental materials, brazing alloys, specifications, tests, marking.

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