ANSI/ADA Standard No. 131
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American National Standard/
American Dental Association

Standard No. 131

Dental CAD/CAM Machinable Zirconia Blanks

ADA American Dental Association®
Council on Scientific Affairs

2015

AMERICAN NATIONAL STANDARD/AMERICAN DENTAL ASSOCIATION STANDARD NO. 131 FOR DENTAL CAD/CAM MACHINABLE ZIRCONIA BLANKS

The Council on Scientific Affairs of the American Dental Association has approved American Dental Association Standard No. 131 for Dental CAD/CAM Machinable Zirconia Blanks. This and other standards for dental materials, instruments and equipment are being formulated by working groups of the ADA Standards Committee on Dental Products. The Committee has representation from all interests in the United States in the standardization of materials, instruments and equipment in dentistry. The Council has adopted the standards, showing professional recognition of their usefulness in dentistry, and has forwarded them to the American National Standards Institute with a recommendation that the standards be approved as American National Standards. The American National Standards Institute granted approval of ADA Standard No. 131 as an American National Standard on May 29, 2015.

The ADA Standards Committee on Dental Products thanks the members of Working Group 9.65 on Dental CAD/CAM Machinable Zirconia Blanks and the organizations with which they were affiliated at the time the standard was developed:

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FOREWORD

(This Foreword does not form a part of ANSI/ADA Standard No. 131 for Machinable Zirconia Blanks).

The following test methods have been excerpted from ISO 6872:2008, *Dentistry — Ceramic materials*:
7.2 – Radioactivity;
7.3 – Flexural strength;
7.4 – Thermal expansion;
7.6 – Solubility.

Also excerpted from ISO 6872:2008:
9 – Packaging, marking and labeling.

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1 SCOPE

This standard specifies the requirements and test methods for partially stabilized zirconia materials used for the fabrication of dental fixed restorations.

Specific qualitative and quantitative requirements for freedom from biological hazard are not included in this standard, but it is recommended that, in assessing possible biological or toxicological hazards, reference be made to ANSI/ADA Standard No. 41, ISO 10993-1 and ISO 7405.

2 TERMS AND DEFINITIONS

In this standard, the terms and definitions contained within ISO 1942, ISO 6872, ANSI/ADA Standard No. 33, and the following apply.

2.1 Materials

2.1.1 Zirconia

Zirconia (ZrO_2) is the oxidized form of the metal zirconium (Zr). It exhibits three well defined crystal structures (polymorphs or phases); Monoclinic, Tetragonal and Cubic. At room temperature, pure zirconia has a monoclinic crystal structure and this type of zirconia has a low strength and low resistance to thermal shock, hence, it has limited industrial applications except as additives for pigments or ceramic colors. At 1170°C, the monoclinic phase (polymorph) transforms to the tetragonal phase, and at 2370°C, it transforms to the cubic phase and remains at this phase up to the melting point at 2680°C.

2.1.2 Partially stabilized zirconia

Zirconia may exist in cubic or tetragonal phases at room temperature if stabilizing oxides are added. These may be Calcia (CaO), Magnesia (MgO), Yttria (Y_2O_3), or Ceria (CeO_2).

2.1.2.2 Y-TZP (Yttria-tetragonal partially stabilized zirconia)

In most dental zirconia materials the addition of 3% - 5% mol% Yttria is used to partially stabilize the zirconia in the tetragonal phase at room temperature.

2.1.3 Transformation toughening

The tetragonal phase may transform into monoclinic as a result of externally applied stresses exerted by common dental fabrication procedures such as grinding, sandblasting. The tetragonal to monoclinic phase transformation exhibits a 3% to 4% volume expansion that may create compressive stresses surrounding the transformed crystals and act to inhibit crack propagation; “transformation toughening”.

2.1.4 Fully stabilized zirconia

The addition of higher amounts of stabilizing agents to the zirconia may create a zirconia fully stabilized predominantly in the cubic phase at room temperature.

2.1.5 Green zirconia blanks

Machinable blanks of zirconia may be produced by mixing the zirconia powder with a binding agent and pressing the powder in a die to create the blank. Alternatively a suspension of the starting powder may be created and cast into a