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**NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA**

**GB 23101.4-2008**

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**[GB/T 23101.4-2008] Implants for surgery -- Hydroxyapatite --  
Part 4: Determination of coating adhesion strength**

外科植入物 羟基磷灰石 第4部分：涂层粘结强度的测定

**(English Translation)**

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### 1 Scope

GB 23101 of the measurement methods specified in this part of hydroxyapatite coating adhesion strength.

### 2 Normative references

The following documents contain provisions which, through reference in this Part of GB 23101, constitute provisions of this part. For dated reference documents

Member, all subsequent amendments (not including errata content) or revisions do not apply to this section, however, encouraged to reach under this section

Parties to research agreement to use the latest versions of these documents. For undated reference documents, the latest versions apply to this section.

Check tension and (or) pressure testing machine force measuring system. GB/T 16825.1-2002 static uniaxial testing machines - Part 1

Test and calibration (ISO 7500-1.1999, IDT)

### 3 Terms and Definitions

The following terms and definitions apply to this part of GB 23101.

#### 3.1

By sintering the powder grains integrated into cohesion hydroxyapatite crystals block.

#### 3.2

By heat, vapor or liquid phase technique in a non-metal or metal deposited on the surface of distinct layers of different materials.

### 3.3

Having a crystal structure of the International Commission for Diffraction Data (ICDD) powder diffraction card PDF9-432 characterized by chemical composition.

**Note:** Chemical formula.  $\text{Ca}_5(\text{OH})(\text{PO}_4)_3$ .

### 3.4

By heating the powder particle surface area and a significant reduction in the overall volume of the powder and densified, and followed by improving the mechanical properties of ceramics production process.

## 4.1 Principle

Coating adhesion strength is measured on a cylindrical test assembly by applying a uniaxial tensile load, the test assembly consists of a hydroxyl

Hydroxyapatite coating sample uncoated bond a member.

### 4.2.1 mechanical testing machine

Load capacity of not less than 30kN, accuracy no less than  $\pm 2\%$  of full scale mechanical testing machine. The tensile load shall be applied perpendicular to the applied coating on flat surface.

GB 23101.4-2008/ISO 13779-4:2002 (According to GB/T 16825.1 test and calibration of mechanical measuring system)

### 4.2.2 Load component

The load test machine is transmitted to the apparatus test assembly.

Load component should ensure that the shaft and the shaft of the test assembly test deviation between  $\leq 1^\circ$  and  $\pm 0.1\text{mm}$ , thus ensuring vertical surface coating test

To the loading axis. Eccentric loading resulting assembly results invalid.

Figure 1 is a combination of one of the yoke and pin from the loading component instance to meet these requirements. The samples were coated and uncoated parts

Each consists of two vertical pins fixed to allow for axial load deviation is minimized. The specific dimensions charging assembly as specified in Table 1, the appropriate

Close to the expected maximum bond or cohesive strength of the coating test samples 50MPa.

1 --- test module;

- 2 --- pin;
- 3 --- yoke;
- 4 --- binder;
- 5 --- coating to be tested.

Figure 1 so that the smallest deviation from axial loading loading component diagram

#### 4.2.3 Test assembly

Test component parts (the coated samples and uncoated parts) are bonded together with a polymeric binder.

Uncoated substrate samples with the coating member should be the same material, preferred materials are shown in Table 1.

Size uncoated parts shall be coated sample size and the same dimensions and tolerances are shown in Table 1.

Loading and testing of components shown in Figure 2, the provisions applicable to the expected size of the component adhesive or cohesive strength of up to 50MPa coating test.

**Note 1:** The accuracy of this test method is very sensitive to the following factors. Preparation of coated sample, the polymer binder and the use of coated samples and uncoated

Appropriate member of the school straight. Poor alignment can lead to eccentric loads and bending stress on the test assembly, the test result is invalid.

**Note 2:** The bonding surface uncoated parts shall be roughened to aid polymer adhesive bond.

GB 23101.4-2008/ISO 13779-4.2002

1 --- for hydroxyapatite coating deposited on the surface.

Symbols and dimensions defined in Table 1.

#### 4.2.4 polymeric binder

Bond strength greater than 30MPa at least a polymeric binder, or at least higher than the coating adhesion or cohesive strength 5MPa, whichever is larger value. Polymer binder used in all the test report shall be marked.

If the coating is porous portion extended to the coating/substrate interface should operate through careful selection of the coating and to ensure sufficient tack adhesive poly

Polymer binder will not penetrate through the coating to the substrate. Binder penetrate the substrate through the coating will cause the measured result is invalid.

Penetration of the binder can be assessed by examining the cross-section of the test piece.

### 4.3 coating sample preparation

Carefully prepared coating sample. Before assembly and test first checks all samples removed during the test found no special representative

Special coating sample. Hydroxyapatite coating on the coated samples not to be machined. Coating area to be tested shall be the nominal straight

Circular diameter of 25mm (tolerance Table 1) or an equivalent cross-sectional area. Measure and record the cross-sectional area and the sample size coating.

GB 23101.4-2008/ISO 13779-4.2002

If using a sample size or other cross-sectional area, and the resulting data should demonstrate a nominal diameter of 25mm circular sample data is relative

And the like.

### 4.4 School polymeric binder used and tested components straight

Polymer binder should be applied to the coating once the shaft center. It should control the amount of adhesive and the two parts are pressed together in order to maintain the force

Card in coated samples/uncoated part is not formed at the flange connection. Excess adhesive after curing, the application does not harm the integrity of the test assembly

A method for removing. The thickness of the adhesive on the contact surface and parallel test sectional uncoated parts with a binder/coating sample is contacted, and to ensure that Uniform.

To ensure uniaxial testing component alignment during the curing polymeric binder, a required test straightening means rigidly fixed component. This

A device should be able to provide a constant load (typically 0.2MPa) to compensate for shrinkage of the adhesive during curing component.

Table 1 for bonding or adhesive strength of the coating is less than the 50MP Rao test fixture and sample size

Symbol test components/fixtures

Dimensions/mm

Titanium alloy (Ti6Al4V) 316 stainless steel

Ladder-type test piece  $25 \pm 0.05$   $25 \pm 0.05$

Straight test piece 25-0.02-0.041 25-0.02-0.041

Rao sample segment shank diameter 20-0.02-0.041 18-0.02-0.041