



## Standard Test Method for Tension Testing of Calcium Phosphate and Metallic Coatings<sup>1</sup>

This standard is issued under the fixed designation F 1147; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers tension testing of calcium phosphate and metallic porous coatings adhering to dense metal substrates at ambient temperatures. It assesses the degree of adhesion of coatings to substrates, or the internal cohesion of a coating in tension normal to the surface plane.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 633 Test Method for Adhesion or Cohesive Strength of Flame-Sprayed Coatings<sup>2</sup>

E 4 Practices for Force Verification of Testing Machines<sup>3</sup>

E 6 Terminology Relating to Methods of Mechanical Testing<sup>3</sup>

E 8 Test Methods for Tension Testing of Metallic Materials<sup>3</sup>

### 3. Terminology

3.1 The definitions of terms relating to tension testing appearing in Terminology E 6 shall be considered as applying to the terms used in this test method.

### 4. Summary of Test Method

4.1 The tensile test method consists of subjecting a specimen assembly composed of one coated and one uncoated component to a tensile load. In the case of the calcium phosphate coatings, the components to be tested must be bonded together by use of a polymeric adhesive. In the case of the metallic coatings, the components may either be bonded

with the adhesive, or sintered together. The adhesive may be in film form or bulk form, but it must have a minimum bulk tensile strength of 34.5 MPa (5000 psi).

4.2 The tensile load must be applied normal to the plane of the coating utilizing a tension machine which is capable of determining the maximum strength of the coating or coating attachment to the substrate interface.

### 5. Significance and Use

5.1 The tensile test method is recommended for tension testing of calcium phosphate/substrate or porous metal coating/substrate combinations and can provide information on the adhesive or cohesive strength of coatings under (uniaxial) tensile stress.

5.2 The test method may be useful for comparative evaluation of adhesive or cohesive strengths of a variety of types of coatings. Coatings may be applied using a variety of methods, including but not limited to plasma-spraying and sintering. Information developed using this method may be useful for certain quality control and design purposes.

5.3 The test should not be considered to provide an intrinsic value for utilization directly in making calculations such as determining the ability of a coating to withstand specified environmental stresses.

5.4 Processing variables such as substrate preparation prior to coating, surface texture, coating technique variables or postcoating heat treatment variables may introduce a significant effect on the results of the tension test. The specimen being evaluated must be representative of the actual end use coating.

### 6. Apparatus

6.1 *Testing Machines*—Machines used for testing shall conform to the requirements of Practices E 4. The loads used in determining tensile strength and yield strength shall be within the loading range of the testing machine as defined in Practices E 4.

#### 6.2 Gripping Devices:

6.2.1 *General*—Various types of grips may be used to transmit the load applied to the specimens by the testing machine. To ensure axial tensile stress, it is important that the specimen axis coincide with the centerline of the heads of the testing machine and that the coating test plane be perpendicular

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.15 on Materials Test Methods.

Current edition approved March 10, 1999. Published June 1999. Originally published as F 1147 – 88. Last previous edition F 1147 – 95.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 02.05.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.