



Standard Specification for Titanium and Titanium-6 Aluminum-4 Vanadium Alloy Powders for Coatings of Surgical Implants¹

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1. Scope

1.1 This specification covers the requirements for unalloyed titanium and Ti-6Al-4V alloy powders for use in fabricating coatings on titanium alloy implants.

1.2 Powders covered under this specification may be used to form coatings by sintering or thermal spraying techniques.

1.3 This specification covers powder requirements only. It does not address properties of the coatings formed from them.

2. Referenced Documents

2.1 ASTM Standards:

B 214 Test Method Sieve Analysis of Granular Metal Powders²

B 215 Practices for Sampling Finished Lots of Metal Powders²

B 299 Specification for Titanium Sponge³

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁴

E 120 Test Methods for Chemical Analysis of Titanium and Titanium Alloys⁵

F 67 Specification for Unalloyed Titanium for Surgical Implant Applications⁶

F 981 Practice for Assessment of Compatibility of Biomaterials for Surgical Implants With Respect to Effect of Materials on Muscle and Bone⁶

F 1472 Specification for Wrought Ti-6Al-4V Alloy for Surgical Implant Applications⁶

2.2 American Society for Quality (ASQ) Standards:⁷

ASQ C1 General Requirements for a Quality Program

2.3 Aerospace Material Specifications:⁸

AMS 2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys

AMS 4998A Powder, 6Al-4V, Premium Quality (noncurrent)

3. Methods of Manufacture

3.1 Powders may be manufactured by the plasma rotating electrode process, inert gas atomization, hydride-dehydride, or other method capable of producing powder meeting the requirements of this specification.

4. Chemical Requirements

4.1 The chemical analysis of the powder shall conform to the requirements set forth in Table 1. Analysis shall be performed before the addition of any processing aids.

4.1.1 Requirements for the major and minor elemental constituents for unalloyed titanium and Ti-6Al-4V alloy powders are listed in Table 1. Also listed are all important residual elements. Analysis for elements not listed in Table 1 is not required to verify compliance with this specification.

4.2 The product analysis tolerance shall conform to the requirements set forth in Table 2.

4.3 For referee purposes, Test Methods E 120 shall be used.

4.4 Intentional elemental additions other than those specified in Table 1 are not permitted.

4.5 For powder that includes particle size fractions finer than 200 mesh (74 μm), the oxygen content limits shall be agreed upon between buyer and seller.

5. Particle Size and Shape

5.1 Powder shall be sieved to the customer's requirements with stainless steel screens conforming to Specification E 11. Analysis of sieved powder for conformance to the customer's particle size range requirements shall be in accordance with Test Method B 214.

5.2 Powder made from the plasma rotating electrode process and inert gas atomization tends to be spherical in shape, powder made from the hydride-dehydride process tends to be

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² Annual Book of ASTM Standards, Vol 02.05.

³ Annual Book of ASTM Standards, Vol 02.04.

⁴ Annual Book of ASTM Standards, Vol 14.02.

⁵ Annual Book of ASTM Standards, Vol 03.05.

⁶ Annual Book of ASTM Standards, Vol 13.01.

⁷ Available from the American Society for Quality, 600 N. Plankinton Ave., Milwaukee, WI 53203.

⁸ Available from Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096-0001.