



Designation: E 539 – 90 (Reapproved 1996)^{ε1}

Standard Test Method for X-Ray Emission Spectrometric Analysis of 6Al-4V Titanium Alloy¹

This standard is issued under the fixed designation E 539; 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.

^{ε1} NOTE—Keywords were added editorially in December 1996.

1. Scope

1.1 This test method covers the X-ray emission analysis of 6Al-4V titanium alloy for the following elements in the ranges indicated (Note 1):

Element	Concentration Range, %
Aluminum	4.6 to 7.2
Vanadium	2.6 to 5.4
Iron	0.1 to 0.3

NOTE 1—The concentration ranges can be extended by use of suitable standards. The ranges for aluminum and vanadium represent the actual concentration ranges of the NIST² standard reference materials used when this method was tested. The maximum concentrations of the unknowns used in the cooperative test program were all lower than the reference materials. The iron concentration range was determined by in-house reference materials used by the cooperating laboratories.

1.2 This test method is designed for control analysis in the production of titanium alloys and for inspection testing of the product shipped to the consumer. It is applicable for analyzing cast or wrought samples having a diameter of approximately 32 mm and a thickness of approximately 25 mm.

NOTE 2—Samples of greater or lesser size than the size designed may be used with specially designed sample holders.

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.* Specific precautionary statements are given in Section 8.

2. Referenced Documents

2.1 ASTM Standards:

¹ This test method is under the jurisdiction of ASTM Committee E-1 on Analytical Chemistry for Metals, Ores and Related Materials and is the direct responsibility of Subcommittee E1.06 on Ti, Zr, W, Mo, Ta, Nb, Hf.

Current edition approved July 27, 1990. Published September 1990. Originally published as E 539 – 75. Last previous edition E 539 – 75 (1989)^{ε1}.

² National Institute of Standards and Technology Reference Material Nos. 653, 654, and 655, available from National Institute of Standards and Technology, Washington, DC 20234.

E 120 Test Methods for Chemical Analysis of Titanium and Titanium Alloys³

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials³

3. Terminology

3.1 Definitions:

3.1.1 Refer to Terminology E 135.

4. Summary of Test Method

4.1 The sample is finished to a clean, uniform surface and then irradiated by an X-ray beam of high energy (short wavelength). The secondary X rays produced are dispersed by means of crystals and the intensities measured by detectors at selected wavelengths. The outputs of the detectors in voltage pulses are integrated or counted. Data are collected using time required to reach a fixed number of counts or using total counts for a fixed time. Concentrations of the elements are determined by relating the measured radiation of unknown samples to analytical curves or charts prepared from standard reference materials of known compositions. A fixed channel or polychromator system or a sequential system may be used to provide simultaneous or sequential determinations of elements.

5. Significance and Use

5.1 The chemical composition of 6Al-4V titanium alloy must be accurately determined to ensure the desired metallurgical properties. This test method is suitable for manufacturing control and inspection testing.

6. Apparatus

NOTE 3—It is not within the scope of this test method to prescribe all details of equipment to be used. Equipment varies between laboratories.

6.1 Sample Preparation Equipment:

6.1.1 *Surface Grinder*, with 60 to 600-grit silicon carbide belts or disks capable of providing test specimens with a uniform flat finish. A wet belt or wet disk grinder is preferred to prevent work hardening of the sample.

6.2 Excitation Source:

³ Annual Book of ASTM Standards, Vol 03.05.