



# Standard Test Method for Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry<sup>1</sup>

This standard is issued under the fixed designation E539; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method<sup>2</sup> covers the X-ray fluorescence analysis of titanium alloys for the following elements in the ranges indicated:

| Element    | Mass Fraction Range, % |
|------------|------------------------|
| Aluminum   | 0.041 to 8.00          |
| Chromium   | 0.013 to 4.00          |
| Copper     | 0.015 to 0.60          |
| Iron       | 0.023 to 2.00          |
| Manganese  | 0.003 to 9.50          |
| Molybdenum | 0.005 to 4.00          |
| Nickel     | 0.005 to 0.80          |
| Niobium    | 0.004 to 7.50          |
| Palladium  | 0.014 to 0.200         |
| Ruthenium  | 0.019 to 0.050         |
| Silicon    | 0.014 to 0.15          |
| Tin        | 0.017 to 3.00          |
| Vanadium   | 0.017 to 15.50         |
| Yttrium    | 0.0011 to 0.0100       |
| Zirconium  | 0.007 to 4.00          |

1.2 *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 10.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>3</sup>

[E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials](#)

[E1172 Practice for Describing and Specifying a Wavelength-Dispersive X-Ray Spectrometer](#)

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.06 on Ti, Zr, W, Mo, Ta, Nb, Hf, Re.

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<sup>2</sup> Supporting data for this test method as determined by cooperative testing has been filed at ASTM International Headquarters as three separate research reports RR:E02-1010, RR:E01-1061, RR:E01-1114.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[E1329 Practice for Verification and Use of Control Charts in Spectrochemical Analysis](#)

[E1361 Guide for Correction of Interelement Effects in X-Ray Spectrometric Analysis](#)

[E1621 Guide for X-Ray Emission Spectrometric Analysis](#)

[E1724 Guide for Testing and Certification of Metal, Ore, and Metal-Related Reference Materials \(Withdrawn 2010\)](#)<sup>4</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [E135](#).

## 4. Summary of Test Method

4.1 The specimen is finished to a clean, uniform surface and then irradiated by high-energy X-ray photons. Secondary X rays are produced and emitted from the sample. This radiation is diffracted by means of crystals and focused on a detector, which measures the count rates at specified wavelengths. The output(s) of the detector(s) is integrated or counted for a fixed time or until the counts reach a certain fixed number. Mass fractions of the elements are determined by relating the measured radiation of unknown samples to calibration curves prepared using reference materials of known compositions.

## 5. Significance and Use

5.1 This method is suitable for providing data on the chemical composition of titanium alloys having compositions within the scope of the standard. It is intended for routine production control and for determination of chemical composition for the purpose of certifying material specification compliance. Additionally, the analytical performance data included with this method may be used as a benchmark to determine if similar X-ray spectrometers provide equivalent precision and accuracy.

## 6. Interferences

6.1 Line overlaps, interelement effects and matrix effects may exist for some of the elements in the scope. A list of

<sup>4</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).