



Standard Test Method for Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry (Performance-Based Method)¹

This standard is issued under the fixed designation E2994; 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 describes the analysis of titanium and its alloys by spark atomic emission spectrometry (Spark-AES) and glow discharge atomic emission spectrometry (GD-AES). The titanium specimen to be analyzed may be in the form of a disk, casting, foil, sheet, plate, extrusion or some other wrought form or shape. The elements and ranges covered in the scope by spark-AES of this method are listed below.

Element	Tested Mass Fraction Range (%)
Aluminum	0.008 to 7.0
Chromium	0.006 to 0.1
Copper	0.014 to 0.1
Iron	0.043 to 0.3
Manganese	0.005 to 0.1
Molybdenum	0.014 to 0.1
Nickel	0.006 to 0.1
Silicon	0.018 to 0.1
Tin	0.02 to 0.1
Vanadium	0.015 to 5.0
Zirconium	0.013 to 0.1

1.1.1 The elements oxygen, nitrogen, carbon, niobium, boron, yttrium, palladium, and ruthenium, were included in the ILS but the data did not contain the required six laboratories. Precision tables were provided for informational use only.

1.2 The elements and ranges covered in the scope by GD-AES of this method are listed below.

Element	Tested Mass Fraction Range (%)
Aluminum	0.02 to 7.0
Chromium	0.006 to 0.1
Copper	0.028 to 0.1
Iron	0.09 to 0.3
Molybdenum	0.016 to 0.1
Nickel	0.006 to 0.1
Silicon	0.018 to 0.1
Tin	0.022 to 0.1
Vanadium	0.054 to 5.0

¹ 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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Element	Tested Mass Fraction Range (%)
Zirconium	0.026 to 0.1

1.3 The mass fractions given in the above scope tables are the ranges validated through the interlaboratory study. However, it is known that the techniques used in this standard allow the useable range to be extended higher or lower based on individual instrument and laboratory capabilities, and the spectral characteristics of the specific element wavelength being used. Laboratories must provide sufficient evidence of method validation when extending the analytical range as described in Guide E2857 Validating Analytical Methods.

1.4 *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 safety hazard statements are given in Section 9.*

2. Referenced Documents

2.1 ASTM Standards:²

- E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials
- E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods
- E305 Practice for Establishing and Controlling Atomic Emission Spectrochemical Analytical Curves
- E406 Practice for Using Controlled Atmospheres in Spectrochemical Analysis
- E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
- E1329 Practice for Verification and Use of Control Charts in Spectrochemical Analysis
- E1507 Guide for Describing and Specifying the Spectrometer of an Optical Emission Direct-Reading Instrument

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.