



Standard Test Method for Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Plasma Atomic Emission Spectrometry (Performance-Based Test Methodology)¹

This standard is issued under the fixed designation E2371; 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 method describes the analysis of titanium and titanium alloys, such as specified by committee B10, by inductively coupled plasma atomic emission spectrometry (ICP-AES) and direct current plasma atomic emission spectrometry (DCP-AES) for the following elements:

Element	Application Range (wt.%)	Quantitative Range (wt.%)
Aluminum	0–8	0.009 to 8.0
Boron	0–0.04	0.0008 to 0.01
Cobalt	0–1	0.006 to 0.1
Chromium	0–5	0.005 to 4.0
Copper	0–0.6	0.004 to 0.5
Iron	0–3	0.004 to 3.0
Manganese	0–0.04	0.003 to 0.01
Molybdenum	0–8	0.004 to 6.0
Nickel	0–1	0.001 to 1.0
Niobium	0–6	0.008 to 0.1
Palladium	0–0.3	0.02 to 0.20
Ruthenium	0–0.5	0.004 to 0.10
Silicon	0–0.5	0.02 to 0.4
Tantalum	0–1	0.01 to 0.10
Tin	0–4	0.02 to 3.0
Tungsten	0–5	0.01 to 0.10
Vanadium	0–15	0.01 to 15.0
Yttrium	0–0.04	0.001 to 0.004
Zirconium	0–5	0.003 to 4.0

1.2 This test method has been interlaboratory tested for the elements and ranges specified in the quantitative range part of the table above. It may be possible to extend this test method to other elements or broader mass fraction ranges as shown in the application range part of the table above provided that test method validation is performed that includes evaluation of method sensitivity, precision, and bias. Additionally, the validation study shall evaluate the acceptability of sample preparation methodology using reference materials or spike recoveries or both. Guide E2857 provides information on validation of analytical methods for alloy analysis.

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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1.3 Because of the lack of certified reference materials (CRMs) containing bismuth, hafnium, and magnesium, these elements were not included in the scope or the interlaboratory study (ILS). It may be possible to extend the scope of this test method to include these elements provided that method validation includes the evaluation of method sensitivity, precision, and bias during the development of the testing method.

1.4 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.5 *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 hazards statements are given in Section 9.

2. Referenced Documents

2.1 ASTM Standards:²

D1193 Specification for Reagent Water

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E1097 Guide for Determination of Various Elements by Direct Current Plasma Atomic Emission Spectrometry

E1329 Practice for Verification and Use of Control Charts in Spectrochemical Analysis

E1479 Practice for Describing and Specifying Inductively-Coupled Plasma Atomic Emission Spectrometers

E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

E1763 Guide for Interpretation and Use of Results from Interlaboratory Testing of Chemical Analysis Methods

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.