



Standard Test Method for Determination of Metallic Impurities in Uranium Metal or Compounds by DC-Arc Emission Spectroscopy¹

This standard is issued under the fixed designation C 1517; 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 steps necessary for the preparation and determination of impurity metals in uranium metal and uranium compounds by DC arc emission spectroscopy.

1.2 The method is valid for those materials that can be dissolved in acid and/or converted to an oxide in a muffle furnace (see Practice C 1347).

1.3 This method uses the carrier distillation technique to selectively carry the impurities into the arc, leaving the uranium oxide in the electrode. If it is necessary to determine the carrier metal (usually a silver or strontium, or gallium compound) as an impurity, another technique must be chosen for that element.

1.4 *This standard may involve hazardous materials, operations and equipment. 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.*

2. Referenced Documents

2.1 ASTM Standards:

- C 753 Specification for Nuclear Grade, Sinterable Uranium Dioxide Pellets²
- C 761 Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear, and Radiochemical Analysis of Uranium Hexafluoride²
- C 776 Specification for Sintered Uranium Dioxide Pellets²
- C 788 Specification for Nuclear Grade Uranyl Nitrate Solutions²
- C 859 Terminology Relating to Nuclear Materials²
- C 967 Specification for Uranium Ore Concentrate²
- C 1347 Practice for Preparation and Dissolution of Uranium Materials for Analysis²
- E 115 Practice for Photographic Processing in Optical

Emission Spectrographic Analysis³

- E 116 Practice for Photographic Photometry in Spectrochemical Analysis³
- E 130 Practice for Designation of Shapes and Sizes of Graphite Electrode³
- E 135 Terminology Relating to Analytical Chemistry for Metals, Ores and Related Materials³
- E 402 Test Method for Spectrographic Analysis of Uranium Oxide (U_3O_8) by Gallium Oxide Carrier Technique⁴

3. Terminology

- 3.1 See definitions and terms in Terminologies C 859 and E 135.

4. Summary of Test Method

4.1 Uranium metal, solutions and compounds are converted to uranium oxide (U_3O_8) in a muffle furnace. A weighed amount of the oxide is mixed with an appropriate spectrographic carrier and loaded into a graphite electrode. The electrode is excited in a DC arc and the light is dispersed by a spectrograph or spectrometer. The resulting spectrum is measured electronically or photographed on photographic plates or film sensitive to the proper regions. The line intensities are compared directly to standard plates or to calibration curves derived from the arced standards.

5. Significance and Use

5.1 This test method is applicable to uranium metal, uranium oxides and compounds soluble in nitric or sulfuric acid, and uranium solutions which can be converted to uranium oxide (U_3O_8) in a muffle furnace. It may be used to determine the impurities in uranium compounds as listed in Specifications C 753, C 776, C 788, and C 967.

6. Apparatus

6.1 *Spectrograph*—A spectrograph with sufficient resolving power and linear dispersion to separate the analytical lines from other lines in the spectrum of the sample in the spectral region of 230.0 to 855.0 nm is required. Instruments with a reciprocal linear dispersion in the first order of 0.5 nm/mm or

¹ This test method is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Test Methods.

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² *Annual Book of ASTM Standards*, Vol 12.01.

³ *Annual Book of ASTM Standards*, Vol 03.05.

⁴ *Annual Book of ASTM Standards*, Vol 03.06.