



## Standard Practice for Preparation and Dissolution of Uranium Materials for Analysis<sup>1</sup>

This standard is issued under the fixed designation C1347; 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.

<sup>ε1</sup> NOTE—Editorially relocated warning statement in 8.2.2 in June 2014.

### 1. Scope

1.1 This practice covers dissolution treatments for uranium materials that are applicable to the test methods used for characterizing these materials for uranium elemental, isotopic, and impurities determinations. Dissolution treatments for the major uranium materials assayed for uranium or analyzed for other components are listed.

1.2 The treatments, in order of presentation, are as follows:

| Procedure Title                                                                                                                  | Section |
|----------------------------------------------------------------------------------------------------------------------------------|---------|
| Dissolution of Uranium Metal and Oxide with Nitric Acid                                                                          | 8.1     |
| Dissolution of Uranium Oxides with Nitric Acid and Residue Treatment                                                             | 8.2     |
| Dissolution of Uranium-Aluminum Alloys in Hydrochloric Acid with Residue Treatment                                               | 8.3     |
| Dissolution of Uranium Scrap and Ash by Leaching with Nitric Acid and Treatment of Residue by Carbonate Fusion                   | 8.4     |
| Dissolution of Refractory Uranium-Containing Material by Carbonate Fusion                                                        | 8.5     |
| Dissolution of Uranium—Aluminum Alloys Uranium Scrap and Ash, and Refractory Uranium-Containing Materials by Microwave Treatment | 8.6     |

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 hazards statements are given in Section 7.

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

C753 Specification for Nuclear-Grade, Sinterable Uranium Dioxide Powder

C776 Specification for Sintered Uranium Dioxide Pellets

C1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis

D1193 Specification for Reagent Water

### 3. Summary of Practice

3.1 Many uranium-containing materials such as high-purity metals and oxides dissolve readily in various mineral acids. The dissolution of uranium-plutonium mixed oxides is covered in Practice C1168. Highly refractory materials require prior grinding of samples and fusions to affect even partial dissolution. Combinations of the mineral acid and fusion techniques are used for difficult to dissolve materials.<sup>3,4,5</sup> Alternatively, the combination of acids and a high pressure microwave have been found to be effective with more difficult to dissolve materials and can also be used for materials which dissolve in mineral acid in place of heating with a steam bath or hot plate.

3.2 The dissolved materials are quantitatively transferred to tared polyethylene bottles for subsequent sample solution mass determination and factor calculation. Aliquants are obtained by mass for high-precision analysis or by volume for less precise analysis methods. Quantitative transfers of samples and subsequent solutions are required. The sample is rejected whenever a loss is incurred, or even suspected.

<sup>2</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.

<sup>3</sup> *Selected Measurement Methods for Plutonium and Uranium in the Nuclear Fuel Cycle*, Second Edition, C. J. Rodden, ed., U.S. Atomic Energy Commission, 1972.

<sup>4</sup> *Analysis of Essential Nuclear Reactor Materials*, C. J. Rodden, ed., U.S. Atomic Energy Commission, 1964.

<sup>5</sup> Larsen, R. P., "Dissolution of Uranium Metal and Its Alloys," *Analytical Chemistry*, Vol 31, No. 4, 1959, pp. 545–549.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Methods of Test.

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