



Standard Practice for The Ion Exchange Separation of Small Volume Samples Containing Uranium, Americium, and Plutonium Prior to Isotopic Abundance and Content Analysis¹

This standard is issued under the fixed designation C1816; 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 practice is an alternative to Practice C1411 for the ion exchange separation in small mass samples (~5 µg of plutonium and up to 0.5 mg of uranium in 1 mL of solution) of uranium and plutonium from each other and from other impurities for subsequent isotopic abundance and content analysis by thermal ionization mass spectrometry (TIMS). In addition to being adapted to smaller sample sizes, this practice also avoids the use of hydrochloric acid (HCl) and hydrofluoric acid (HF) and does not require the use of two anion exchange columns as required in Practice C1411.

1.2 In chemically unseparated samples isobaric nuclides at mass 238 (²³⁸U and ²³⁸Pu), and mass 241 (²⁴¹Pu and ²⁴¹Am) will be measured together thus compromising the accuracy of the results of isotopic composition of Pu. Therefore, chemical separation of elements is essential prior to isotopic analyses. Concentrations and volumes given in the paragraphs below can be modified for larger sample sizes, different types of anion exchange resin, etc.

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.*

2. Referenced Documents

2.1 ASTM Standards:²

¹ 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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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.

C698 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Mixed Oxides ((U, Pu)O₂)

C833 Specification for Sintered (Uranium-Plutonium) Dioxide Pellets

C859 Terminology Relating to Nuclear Materials

C1008 Specification for Sintered (Uranium-Plutonium) Dioxide Pellets—Fast Reactor Fuel (Withdrawn 2014)³

C1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis

C1347 Practice for Preparation and Dissolution of Uranium Materials for Analysis

C1411 Practice for The Ion Exchange Separation of Uranium and Plutonium Prior to Isotopic Analysis

C1415 Test Method for ²³⁸Pu Isotopic Abundance By Alpha Spectrometry

C1625 Test Method for Uranium and Plutonium Concentrations and Isotopic Abundances by Thermal Ionization Mass Spectrometry

C1672 Test Method for Determination of Uranium or Plutonium Isotopic Composition or Concentration by the Total Evaporation Method Using a Thermal Ionization Mass Spectrometer

D1193 Specification for Reagent Water

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology C859.

4. Summary of Practice

4.1 Solid samples are dissolved according to Practices C1168 or C1347 or other appropriate methods. The resulting solution is processed by this practice to prepare separate solutions of plutonium and uranium for mass spectrometric isotopic abundance analysis using Test Method C698, C1625, or C1672. Appropriate portions are taken to provide up to 5 µg of plutonium on the ion exchange column to be separated from 0.5 mg or less of uranium. All dilutions should be performed by

³ The last approved version of this historical standard is referenced on www.astm.org.