



Standard Practice for Electrodeposition of the Actinides for Alpha Spectrometry¹

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1. Scope

1.1 This practice covers the preparation of separated actinide fractions for alpha spectrometry measurement.² It is applicable to any of the actinides that can be dissolved in dilute ammonium sulfate solution. Examples of applicable actinide fractions would be the final elution from an ion exchange separation or the final strip from a solvent extraction separation.

1.2 *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 1000 Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectrometry³
- C 1001 Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectrometry³
- C 1163 Test Methods for Mounting Actinides for Alpha Spectrometry Using Neodymium Fluoride³
- C 1205 Test Method for the Radiochemical Determination of Americium-241 in Soil by Alpha Spectrometry³
- D 1193 Specification for Reagent Water⁴

3. Summary of Practice

3.1 Guidance is provided for the electrodeposition of separated actinide fractions onto metal discs. This practice is based on cathodic deposition of the hydrated oxides of the actinides from an acidic medium containing an ammonium salt. The resultant electrodeposited samples are suitable for alpha spectrometry measurements.

4. Significance and Use

4.1 The determination of actinide elements by alpha spec-

trometry measurement is an essential part of many environmental research and monitoring programs. Alpha spectrometry measurements identify and quantify the alpha-emitting actinide elements. A variety of separation methods will typically precede the electrodeposition of a sample for alpha spectrometry measurements. In addition to the electrodeposition procedure presented in this practice, the scientific literature contains other procedures for actinide electrodeposition.

NOTE 1—An alternate method for mounting actinides for alpha spectrometry measurements by coprecipitation with neodymium fluoride is described in Test Methods C 1163.

5. Interferences

5.1 Any element present in the separated fraction which is capable of cathodic electrodeposition will be present on the metal disc. In particular ²¹⁰Po (5.30 MeV) deposited on the disc would interfere with the yield determination of ²³²U (5.32 MeV) or ²⁴³Am (5.28 MeV) tracers used in the determination of isotopic uranium and ²⁴¹Am, respectively.

5.2 Incomplete separation of rare earth elements or incomplete wet ashing for the removal of organic material will decrease the efficiency of the electrodeposition and may result in a thick deposit unsuitable for alpha spectrometry measurement.

5.3 The quantity of actinide should be such that <5 μg cm⁻² are electrodeposited on the metal disc. Thicker deposits are typically unsuitable for measurement by alpha spectrometry due to the resulting attenuation and decrease in energy resolution.

6. Apparatus

6.1 *Electrodeposition Power Supply*—Constant current, adjustable from 0 to 2 A with indicating meter.

6.2 *Electrodeposition Cell*—Disposable cells are recommended. The cells should have a minimum volume capacity of 25 mL.

6.3 *Metal Discs*—Stainless steel disc, or other metal disc such as platinum, polished to a mirror finish on one side. The diameter of the disc is determined by diameter of the electrodeposition cell. The current density should be approximately 0.5 A cm⁻² of the disc area.

6.4 *Electrodeposition Anode*—The exact dimensions of the anode will be determined by the cross-sectional area and depth of the electrodeposition cell. For example, a 1.5 mm diameter

¹ This practice is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.05 on Methods of Test.

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² Based on Talvitie, N. A., "Electrodeposition of Actinides for Alpha Spectrometric Determination," *Analytical Chemistry*, Vol 44, 1972, pp. 280-283.

³ *Annual Book of ASTM Standards*, Vol 12.01.

⁴ *Annual Book of ASTM Standards*, Vol 11.01.