



Standard Test Method for Isotopic Abundance Analysis of Uranium Hexafluoride and Uranyl Nitrate Solutions by Multi-Collector, Inductively Coupled Plasma-Mass Spectrometry¹

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1. Scope

1.1 This test method covers the isotopic abundance analysis of ²³⁴U, ²³⁵U, ²³⁶U and ²³⁸U in samples of hydrolysed uranium hexafluoride (UF₆) by inductively coupled plasma source, multicollector, mass spectrometry (ICP-MC-MS). The method applies to material with ²³⁵U abundance in the range of 0.2 to 6 % mass. This test method is also described in ASTM STP 1344.

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

1.3 *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

C761 Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear, and Radiochemical Analysis of Uranium Hexafluoride

C787 Specification for Uranium Hexafluoride for Enrichment

C996 Specification for Uranium Hexafluoride Enriched to Less Than 5 % ²³⁵U

D1193 Specification for Reagent Water

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 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.

2.2 Other Document:

STP 1344 Applications of Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) to Radionuclide Determinations³

3. Terminology

3.1 Acronyms:

3.1.1 *amu*—atomic mass unit

3.1.2 *ICP-MC-MS*—Inductively Coupled Plasma Multi-Collector Mass Spectrometer

3.1.3 *ICP-MS*—Inductively Coupled Plasma Mass Spectrometer

3.1.4 *UIRM*—Uranium Isotopic Reference Material

4. Summary of Test Method

4.1 Samples are received either in the form of uranium hexafluoride (UF₆) or aqueous uranic solution. The UF₆ samples are hydrolysed, diluted and acidified with nitric acid. Uranic solution samples are diluted and acidified with nitric acid. If required, an internal reference of thorium isotopes can be subsequently added to each diluted sample. As detailed in Section 8, isotope pairs of elements other than thorium could be used for an internal reference.

4.2 The samples are contained in polypropylene tubes that are inserted into the auto-sampler rack of the mass spectrometer. Sample details are input to the computer and the instrument is prepared for measurement. The automatic measuring sequence is initiated.

4.3 Uranium Isotopic Reference Materials (UIRMs) are used to calibrate the instrument. Each UIRM is prepared in aqueous solution (acidified with nitric acid) and if required spiked with the same internal reference as the samples. This calibration solution is measured and a mass bias parameter is

³ Available from ASTM Headquarters.