



Standard Test Method for Determination of Uranium Isotopic Composition by the Modified Total Evaporation (MTE) Method Using a Thermal Ionization Mass Spectrometer¹

This standard is issued under the fixed designation C1832; 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 determination of the isotope amount ratios of uranium material as nitrate solutions by the modified total evaporation (MTE) method using a thermal ionization mass spectrometer (TIMS) instrument.

1.2 The analytical performance in the determination of the $^{235}\text{U}/^{238}\text{U}$ major isotope amount ratio by MTE is similar to the (“classical”) total evaporation (TE) method as described in Test Method C1672. However, in the MTE method, the evaporation process is interrupted on a regular basis to allow measurements and subsequent corrections for background from peak tailing, perform internal calibration of a secondary electron multiplier (SEM) detector versus the Faraday cups, peak centering, and ion source refocusing. Performing these calibrations and corrections on a regular basis during the measurement, improves precision, and significantly reduces uncertainties for the minor isotope amount ratios $^{234}\text{U}/^{238}\text{U}$ and $^{236}\text{U}/^{238}\text{U}$ as compared to the TE method.

1.3 In principle, the MTE method yields major isotope amount ratios without the need for mass fractionation correction. However, depending on the measurement conditions, small variations are seen among sample turrets; therefore, a small correction based on measurements of a certified reference material is recommended to improve consistency. The uncertainty around the mass fractionation correction factor usually includes unity.

1.4 *Units*—The values stated in SI units are to be regarded as the standard. When non-SI units are provided, they are for information only.

1.5 *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

- C753 Specification for Nuclear-Grade, Sinterable Uranium Dioxide Powder
- C776 Specification for Sintered Uranium Dioxide Pellets
- C787 Specification for Uranium Hexafluoride for Enrichment
- C833 Specification for Sintered (Uranium-Plutonium) Dioxide Pellets
- C859 Terminology Relating to Nuclear Materials
- C967 Specification for Uranium Ore Concentrate
- C996 Specification for Uranium Hexafluoride Enriched to Less Than 5 % ^{235}U
- C1008 Specification for Sintered (Uranium-Plutonium) Dioxide Pellets—Fast Reactor Fuel (Withdrawn 2014)³
- C1068 Guide for Qualification of Measurement Methods by a Laboratory Within the Nuclear Industry
- C1128 Guide for Preparation of Working Reference Materials for Use in Analysis of Nuclear Fuel Cycle Materials
- C1156 Guide for Establishing Calibration for a Measurement Method Used to Analyze Nuclear Fuel Cycle Materials
- 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
- 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

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.

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