



Designation: C 698 – 98

Standard Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Mixed Oxides ((U, Pu)O₂)¹

This standard is issued under the fixed designation C 698; 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 These test methods cover procedures for the chemical, mass spectrometric, and spectrochemical analysis of nuclear-grade mixed oxides, (U, Pu)O₂, powders and pellets to determine compliance with specifications.

1.2 The analytical procedures appear in the following order:

	Sections
Uranium by Controlled-Potential Coulometry	2
Plutonium by Controlled-Potential Coulometry	2
Plutonium by Amperometric Titration with Iron (II)	2
Nitrogen by Distillation Spectrophotometry Using Nessler Reagent	7 to 14
Carbon (Total) by Direct Combustion-Thermal Conductivity	15 to 26
Total Chlorine and Fluorine by Pyrohydrolysis	27 to 34
Sulfur by Distillation-Spectrophotometry	35 to 43
Moisture by the Coulometric, Electrolytic Moisture Analyzer	44 to 51
Isotopic Composition by Mass Spectrometry	3
Rare Earths by Copper Spark Spectroscopy	52 to 59
Trace Impurities by Carrier Distillation Spectroscopy	60 to 69
Impurities by Spark-Source Mass Spectrography	70 to 76
Total Gas in Reactor-Grade Mixed Dioxide Pellets	77 to 84
Tungsten by Dithiol-Spectrophotometry	85 to 93
Rare Earth Elements by Spectroscopy	94 to 97
Plutonium-238 Isotopic Abundance by Alpha Spectrometry	98 to 105
Americium-241 in Plutonium by Gamma-Ray Spectrometry	
Uranium and Plutonium Isotopic Analysis by Mass Spectrometry	106 to 114
Oxygen-to-Metal Atom Ratio by Gravimetry	115 to 123

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.* (For specific safeguard and safety precaution statements, see Sections 11, 20, 64, and 120 and 110.6.1.)

2. Referenced Documents

2.1 ASTM Standards:

C 697 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Plutonium

¹ These test methods are under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and are the direct responsibility of Subcommittee C26.05 on Methods of Test.

Current edition approved Feb. 10, 1998. Published June 1998. Originally published as C698 – 72. Last previous edition C698 – 92.

² Discontinued as of Nov. 15, 1992.

³ Discontinued as of May 30, 1980.

Dioxide Powders and Pellets⁴

C 833 Specification for Sintered (Uranium-Plutonium) Dioxide Pellets⁴

C 852 Guide for Design Criteria for Plutonium Gloveboxes
C 1009 Guide for Establishing a Quality Assurance Program for Analytical Chemistry Laboratories Within the Nuclear Industry

C 1068 Guide for Qualification of Measurement Methods by a Laboratory Within the Nuclear Industry

C 1108 Test Method for Plutonium by Controlled-Potential Coulometry

C 1128 Guide for Preparation of Working Reference Materials for Use in the Analysis of Nuclear Fuel Cycle Materials

C 1156 Guide for Establishing Calibration for a Measurement Method Used to Analyze Nuclear Fuel Cycle Materials

C 1165 Test Method for Determining Plutonium by Controlled-Potential Coulometry in H₂SO₄ at a Platinum Working Electrode⁴

C 1168 Practice for Preparation and Dissolution of Plutonium Materials for Analysis

C 1204 Test Method for Uranium in the Presence of Plutonium by Iron (II) Reduction in Phosphoric Acid Followed by Chromium (VI) Titration⁴

C 1206 Test Method for Plutonium by Iron (II)/Chromium (VI) Amperometric Titration⁴

C 1210 Guide for Establishing a Measurement System Quality Control Program for Analytical Chemistry Laboratories Within the Nuclear Industry

C 1268 Test Method for Quantitative Determination of Americium 241 in Plutonium by Gamma-Ray Spectrometry

C 1297 Guide for Qualification of Laboratory Analysts for the Analysis of Nuclear Fuel Cycle Materials

D 1193 Specification for Reagent Water⁵

E 60 Practice for Photometric and Spectrophotometric Methods for Chemical Analysis of Metals⁶

E 115 Practices for Photographic Processing in Optical

⁴ Annual Book of ASTM Standards, Vol 12.01.

⁵ Annual Book of ASTM Standards, Vol 11.01.

⁶ Annual Book of ASTM Standards, Vol 03.05.