



Standard Test Method for The Analysis of Refrigerant 114, Plus Other Carbon- Containing and Fluorine-Containing Compounds in Uranium Hexafluoride via Fourier-Transform Infrared (FTIR) Spectroscopy¹

This standard is issued under the fixed designation C1441; 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 covers determining the concentrations of refrigerant-114, some other carbon-containing and fluorine-containing compounds, hydrocarbons, and partially or completely substituted halohydrocarbons that may be impurities in uranium hexafluoride when looked for specifically. The two options are outlined for this test method. They are designated as Part A and Part B.

1.1.1 To provide instructions for performing Fourier-Transform Infrared (FTIR) spectroscopic analysis for the possible presence of Refrigerant-114 impurity in a gaseous sample of uranium hexafluoride, collected in a “2S” container or equivalent at room temperature. The all gas procedure applies to the analysis of possible Refrigerant-114 impurity in uranium hexafluoride, and to the gas manifold system used for FTIR applications. The pressure and temperatures must be controlled to maintain a gaseous sample. The concentration units are in mole percent. This is Part A.

1.2 The method described in part B is more efficient because there isn't matrix effect. FTIR spectroscopy identifies bonds as C-H, C-F, C-Cl. To quantify HCH compounds, these compounds must be known and the standards available to do the calibration.

After a screening, if the spectrum is the UF_6 spectrum or if the other absorption peaks allow the HCH quantification, this test method can be used to check the compliance of UF_6 as specified in Specifications C787 and C996. The limits of detection are in units of mole percent concentration.

1.3 Part A pertains to Sections 7 – 10 and Part B pertains to Sections 12 – 16.

1.4 These test options are applicable to the determination of hydrocarbons, chlorocarbons, and partially or completely substituted halohydrocarbons contained as impurities in uranium

hexafluoride (UF_6). Gases such as carbon tetrafluoride (CF_4), which absorb infrared radiation in a region where uranium hexafluoride also absorbs infrared radiation, cannot be analyzed in low concentration via these methods due to spectral overlap/interference.

1.5 These test options are quantitative and applicable in the concentration ranges from 0.003 to 0.100 mole percent, depending on the analyte.

1.6 These test methods can also be used for the determination of non-metallic fluorides such as silicon tetrafluoride (SiF_4), phosphorus pentafluoride (PF_5), boron trifluoride (BF_3), and hydrofluoric acid (HF), plus metal-containing fluorides such as molybdenum hexafluoride (MoF_6). The availability of high quality standards for these gases is necessary for quantitative analysis.

1.7 These methods can be extended to other carbon-containing and inorganic gases as long as:

1.7.1 There are not any spectral interferences from uranium hexafluoride's infrared absorbances.

1.7.2 There shall be a known calibration or known “K” (value[s]) for these other gases.

1.8 The values stated in SI units are to be regarded as the standard.

1.9 *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

¹ This test method is under the jurisdiction of ASTM Committee C26 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.