

Designation: F 1374 – 92 (Reapproved 1999)

Standard Test Method for Ionic/Organic Extractables of Internal Surfaces-IC/GC/FTIR for Gas Distribution System Components ¹

This standard is issued under the fixed designation F 1374; 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.

INTRODUCTION

Semiconductor clean rooms are serviced by high-purity gas distribution systems. This test method presents a procedure that may be applied for the evaluation of one or more components considered for use in such systems.

1. Scope

- 1.1 This test method establishes a procedure for testing components used in ultra-high-purity gas distribution systems for ionic and organic surface residues.
- 1.2 This test method applies to in-line components containing electronics grade materials in the gaseous form.
 - 1.3 Limitations:
- 1.3.1 This test method is limited by the sensitivity of the detection instruments and by the available levels of purity in extracting solvents. While the ion and gas chromatographic methods are quantitative, the Fourier transform infrared spectroscopy (FTIR) method can be used as either a qualitative or a quantitative tool. In addition, the gas chromatography (GC) and FTIR methods are used to detect hydrocarbons and halogenated substances that remain as residues on component internal surfaces. This eliminates those materials with high vapor pressures, which are analyzed per the total hydrocarbons test, from this test method.
- 1.3.2 This test method is intended for use by operators who understand the use of the apparatus at a level equivalent to twelve months of experience.
- 1.4 The values stated in SI units are to be regarded as the standards. The inch-pound units given in parentheses 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. Specific hazard statements are given in Section 6.

Current edition published Feb. 15, 1992. Approved April 1992.

2. Referenced Documents

- 2.1 ASTM Standards:
- E 1151 Practice for Ion Chromatography Terms and Relationships ²
- 2.2 Union Carbide Standard:

Techniques for Measuring Trace Gas Impurities in High Purity Gases ³

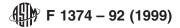
3. Terminology

- 3.1 Definitions of Terms Specific to This Standard:
- 3.1.1 *spool piece*—a null component, consisting of a straight piece of electropolished tubing and appropriate fittings, used in place of the test component to establish the baseline.
- 3.1.2 *standard conditions*—101.3 kPa, 0.0°C (14.73 psia, 32.0°F).
- 3.1.3 *test component*—any device being tested, such as a valve, regulator, or filter.
- 3.1.4 *test fluid blank*—a volume of test solvent adequate for analysis.
- 3.1.4.1 *Discussion*—This is used to determine the background impurity concentrations in the test fluid. This fluid is drawn at the same time as the fluid that is used to fill the spool piece and test component. It must be held in a container that does not contaminate the fluid blank.
 - 3.2 Abbreviations: Abbreviations:
 - 3.2.1 FTIR—Fourier transform infrared spectroscopy.
 - 3.2.2 *GC*—gas chromatography.
 - 3.2.3 *IC*—ion chromatography.
 - 3.2.4 *IPA*—isopropanol (2-propanol).
 - 3.2.5 *MS*—mass spectrometry.
 - 3.2.6 ppbv—parts per billion by volume (such as nL/L).

¹ This test method is under the jurisdiction of ASTM Committee F-1 on Electronics and is the direct responsibility of Subcommittee F01.10 on Processing Environments.

² Annual Book of ASTM Standards, Vol 14.02.

³ Available from Linde Division Union Carbide, 175 E. Park Drive, Tonawanda, NY 14151.



- 3.2.7 ppbw—parts per billion by weight (such as ng/g).
- 3.2.8 ppmv—parts per million by volume (such as µL/L).
- 3.2.9 ppmw—parts per million by weight (such as µg/g).
- 3.2.10 psid—pounds per square inch differential.
- 3.2.11 scfm—standard cubic feet per minute.
- 3.2.12 *slpm*—standard litre per minute. The gas volumetric flow rate measured in litres per minute at 0.0°C (32°F) and 101.3 kPa (1 atm).

4. Significance and Use

4.1 The purpose of this test method is to define a procedure for testing electropolished stainless steel components being considered for installation into a high-purity gas distribution system. Application of this test method is expected to yield comparable data among components tested for the purposes of qualification for this installation.

5. Apparatus

5.1 Materials:

Operator:		
Test Location:		
Spool Piece ID:		
Test Component:		
Model Number:		- Hen S
Serial Number:	-	
Ambient Temperature:		°C
Start Time/Date of Soak:		mae //atar
Finish Time/Date of Soak:	· · · · · · · · · · · ·	
I. Ionic Contribution by ion	chromatography	
D.I. Water		
Resistivity:		Docume
TOC:		D C CAINIC
Spool Piece Baseline		
Species:	μg/l Water	μg/Test Component
•		ACTM E1
		ABIIVII
https://standards	<u>iteh ai/cataloo/star</u>	Marde/eiet/4h9h&
		-
		-
Test Component		
Species:	μg/l Water	μg/Test Component
opedies.	µg/. Trator	µg, root component
	,	1
		-
•		
Serial Number:		
Last Calibration Date: _		
Test Parameters:		
Column:		
Elution System:		
Detector:		
FIG. 1 Ionic/Orga	anic Contribution Data	Table Illustration

Manufacturer:		30
Spool Piece Baseline Retention Time:	μg/I IPA	μg/Test Component
Test Component Retention Time:	μg/l Water	μg/Test Component
Serial Number: Last Calibration Date:		
Test Parameters:		
Injector Temperatu		

- IG. 2 Ionic/Organic Contribution Data Table Illustration
- 5.1.1 *Test Fluid*—The purity of fluid used for the extractions 374 will determine the detection limit of the test. Therefore, extremely high purity fluids are required. At least 18.0 M Ω water [corrected for 18°C (64°F)] must be used for the ionic extractables determination. Total oxidizable carbon must be less than 50 ppbw. The water must be filtered through a 0.2-µm (or finer) filter. Electronics grade (or better) IPA is to be used for the organic extractables determination.
 - 5.1.2 Spool Piece— a straight run of electropolished 316-L stainless steel tubing with no restrictions. The length of the spool piece shall be approximately 200 mm. The spool piece should be the same diameter as the test component.
 - 5.1.3 Caps—used to seal the ends of the test component and spool piece are to be of 316-L stainless steel. For stub end components, 316-L stainless steel compression fittings with nylon or polytetraflouroethylene ferrules are to be used. For face seal fittings, stainless steel gaskets must be used.
 - 5.1.4 Gloves—made of powder free latex or natural rubber and resistant to the test fluids used in this test method.
 - 5.2 Instrumentation:
 - 5.2.1 Ion Chromatograph—The IC is an analytical instrument that detects ionic species in deionized (DI) water. The eluant is passed through a column containing ion exchange resin. A conductivity detector is used to detect the ionic species. The retention times of the various ionic species are used to identify the species. The area under the respective peak yields the quantity of the species in the eluant. This test method