



Designation: E 1559 – 00

Standard Test Method for Contamination Outgassing Characteristics of Spacecraft Materials¹

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1. Scope

1.1 This test method covers a technique for generating data to characterize the kinetics of the release of outgassing products from materials. This technique will determine both the total mass flux evolved by a material when exposed to a vacuum environment and the deposition of this flux on surfaces held at various specified temperatures.

1.2 This test method describes the test apparatus and related operating procedures for evaluating the total mass flux that is evolved from a material being subjected to temperatures that are between 298 and 398K. Pressures external to the sample effusion cell are less than 7×10^{-3} Pa (5×10^{-5} torr). Deposition rates are measured during material outgassing tests. A test procedure for collecting data and a test method for processing and presenting the collected data are included.

1.3 This test method can be used to produce the data necessary to support mathematical models used for the prediction of molecular contaminant generation, migration, and deposition.

1.4 All types of organic, polymeric, and inorganic materials can be tested. These include polymer potting compounds, foams, elastomers, films, tapes, insulations, shrink tubing, adhesives, coatings, fabrics, tie cords, and lubricants.

1.5 There are two test methods in this standard. Test Method A uses standardized specimen and collector temperatures. Test Method B allows the flexibility of user-specified specimen and collector temperatures, material and test geometry, and user-specified QCMs.

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

1.7 *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:

E 177 Practice for Use of the Terms Precision and Bias in

¹ This test method is under the jurisdiction of ASTM Committee E-21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.05 on Contamination.

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ASTM Test Methods²

E 595 Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment³

IEEE/ASTM SI 10-1997 Standard for Use of the International System of Units (SI): The Modern Metric System²

2.2 Military Standard:

MIL-P-27401C Propellant Pressurizing Agent, Nitrogen⁴

3. Terminology

3.1 Definitions:

3.1.1 *AT cut crystal, n*—a quartz crystal orientation that minimizes the temperature coefficient (frequency change versus temperature) over a wide range of temperature.

3.1.2 *collected volatile condensable material, CVCMM, n*—(from Test Method E 595). The quantity of outgassed matter from a test specimen that condenses on a collector maintained at a specific constant temperature for a specified time and measured before and after the test outside the chamber.

3.1.2.1 *Discussion*—CVCMM is specific to Test Method E 595 and is calculated from the condensate mass determined from the difference in mass of the collector plate before and after the test in a controlled laboratory environment. CVCMM is expressed as a percentage of the initial specimen mass. The view factor is not considered; so all the VCM outgassing from the sample may not be collected. Care should be used in comparing the CVCMM from Test Method E 595 with VCM from this test method.

3.1.3 *differential scanning calorimetry, DSC, n*—a technique in which the difference in energy inputs into a substance and a reference material is measured as a function of temperature while the substance and reference material are subjected to a controlled-temperature program.

3.1.4 *effusion cell, n*—a container, placed in a vacuum, in which a sample of material can be placed and heated to some specified temperature.

3.1.4.1 *Discussion*—The container has a cylindrical orifice at one end so that evolving gases exit the cell in a controlled manner. The effusion cell dimensions and orifice size are

² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 15.03.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.