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IEST Updates Recommended Practices to Reflect Leading-edge Methods

New developments covered in Recommended Practices revised recently by the Contamination Control Division of IEST include a test method for characterizing outgassed organic compounds; design and testing of Type IV (vee-bed) modular gas-phase adsorber cells; an automated surface cleaning efficiency test procedure; and production testing of filter types H through K.

Keywords
Outgassing, organic contamination, cleanroom housekeeping, ULPA filters, gas-phase adsorber cells, *IEST-RP-CC007, IEST-RP-CC008, IEST-RP-CC018, IEST-RP-CC031*

Characterizing Outgassed Organic Compounds

IEST-RP-CC031.2: Method for Characterizing Outgassed Organic Compounds from Cleanroom Materials and Components is relevant for any industry that may experience adverse production yields as a result of gaseous organic contamination, also known as volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). In the semiconductor industry, for example, the deposition of outgassed compounds on hardware, products, and wafer surfaces can cause processing problems and hardware failures. In aerospace, molecular contamination can significantly degrade spacecraft performance goals.

This RP describes a test method for semiquantitative determination and qualitative characterization of outgassed organic compounds. The RP specifies four outgassing temperatures—50 °C (122 °F), 75 °C (167 °F), 100 °C (212 °F), and 150 °C (302 °F)—to baseline cleanroom materials and components.

"This recognition that different temperatures can be used to characterize different outgassing conditions that cleanroom materials and components may be subjected to, and thus introduce different levels of outgassing airborne molecular contaminants (AMCs), is as significant today as in 2003 when the RP was first published," noted James Ohlsen, Chair of the Working Group (WG-CC031). "The method in this RP is believed to be the most appropriate analysis to provide chemical information for a large range of organic compounds that may outgas under ambient or higher temperature conditions."

According to Ohlsen, significant revisions to the RP include the following:

- The "Materials of Interest" subsection has been expanded to include more than 50 materials, components of construction, and polymers that may outgas organic compounds of concern.
- An added reference to ISO 14644-8:2006(E) in the subsection "Organic Compounds of Concern" greatly expands the list of contaminating chemicals that can be of concern to a microelectronics product or process.

- New examples in the "Test Material and Sample Preparation" subsection include a solid-to-solid transfer method; cure times for two-part mixtures, coatings, paints, sealants, and caulks; and sample preparations for homogeneous and non-homogeneous materials.
- A new subsection, "Extensions of Outgas Testing Beyond this RP," briefly addresses testing the outgassing of a large part, assembly, or complete system that may be in operation.

The method described in the RP screens for outgassed compounds detectable by thermal desorption gas chromatography mass spectrometry (TD-GC-MS). "Having access to this technology is essential to carrying out the test method described in this RP," explained Ohlsen. "Companies that do not have this capability in-house can utilize contract laboratories that do. Thus, the test method of this RP is accessible to anyone."

IEST-RP-CC031.2 is of interest to engineers, scientists, and educators expert in contamination control for contamination-sensitive industries such as aerospace, data storage, and microelectronics, as well as contamination control experts engaged in cleanroom construction and providers of cleanroom supplies and equipment.

High-efficiency Gas-phase Adsorber Cells

IEST-RP-CC008.2: High-efficiency Gas-phase Adsorber Cells discusses modular cells in single pass or recirculating air-cleaning systems where high-efficiency removal of gaseous contaminants is a requirement. The revised document covers allowable materials, design, construction, quality assurance requirements, and packaging and shipping for the various cells, including new material on Type IV (vee-bed) cells.

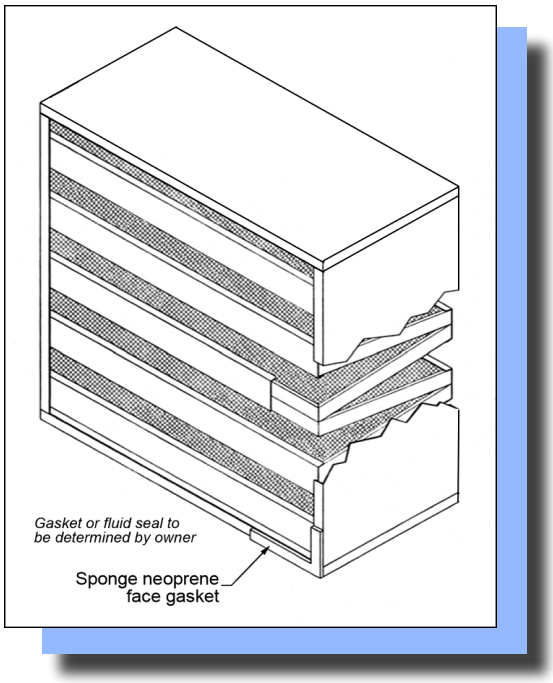

Figure 2—The revised edition includes design and testing information on Type IV (vee-bed) cells. Reprinted from *IEST-RP-CC008.2*.

In addition to adding Type IV adsorbers, the WG "essentially 'retired' Type I adsorbers as they are not currently in commercial production in commercial off-the-shelf (COTS) format," said Arthur Soma, Chair of WG-CC008. "This brings the almost 25-year-old document back into reality.

Manufacturers have not been building the Type I adsorber for years. We left the original language intact as legacy information for those users who require a direct replacement. These changes should be in line with any future releases of the ASME AG-1 code when published."

Further revisions, according to Soma, include the following:

- Removal of the requirement for 99.9% efficiency, thus shifting the efficiency target to the end user to specify in the purchase order.
- Clarification of test apparatus assembly and operation, including language to confirm that wind tunnels are constructed and used in a manner that will not allow challenge agent by-pass.
- Recommendations related to the testing of fluid seal adsorbers to help prevent potential leakage.

"*IEST-RP-CC008.2* sets the stage for application of high-efficiency carbon adsorbers for use in modern systems," said Soma. "The revisions allow users to use the RP to more accurately reflect their requirements without exhaustive customization."

Cleanroom Housekeeping

IEST-RP-CC018.4: Cleanroom Housekeeping: Operating and Monitoring Procedures offers a new test procedure to establish frequency, monitor effectiveness, and determine appropriate levels of surface cleanliness. The document, which provides guidance for maintaining a cleanroom at the level for which it was designed, also contains an expanded section on housekeeping equipment and supplies.

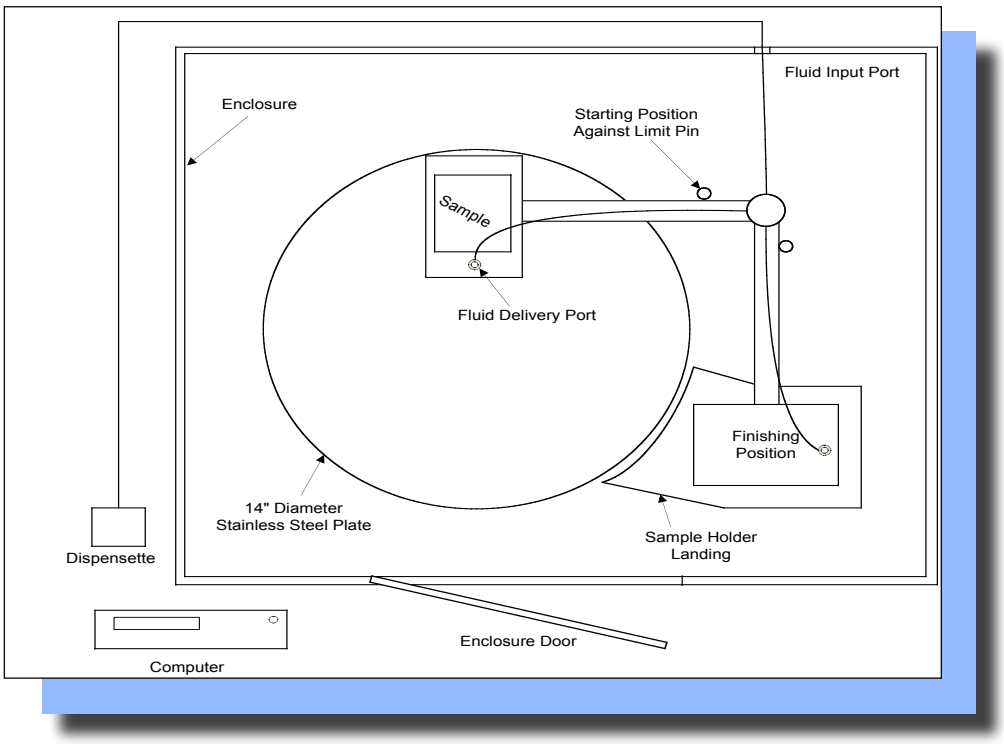

Figure 1—The surface cleaning efficiency test method allows users to simulate different cleaning conditions. A sample substrate is attached to an automated arm that creates a wiping motion across the surface of a rotating platter. Reprinted from *IEST-RP-CC018.4*.

"Since the committee formed in 1982, this document has gone through four updates to stay current with industry standards and technological developments," said Anne Marie Dixon, Chair of WG-CC018. "The new test method in this current revision provides an automated measurement of surface cleanliness as it pertains to the efficiency of the wiping materials. Additional updates include a cleaning frequency chart and a revised cleaning checklist."

Testing ULPA Filters

IEST-RP-CC007.2: Testing ULPA Filters outlines a procedure for production testing of ultralow-penetration air (ULPA) filters for particle penetration and pressure drop. This RP describes the equipment, aerosol properties, processes, and calculations for using particle counters to determine filter efficiency. The penetration range of the procedure is 0.001% to 0.0001%.

The RP provides guidelines for constructing a suitable test duct and sampling system as well as test criteria for quantifying penetration using test aerosol particles in the size range of 0.1 to 0.2 µm. The methodology may also be applied for particle-counter testing of filters outside the efficiency and particle size range covered in the document.

"This document was updated to be reconciled with the new HEPA filters (Type H, I, J and K) now defined in *IEST RP-CC001.4: HEPA and ULPA Filters*. These filters are tested using the particle counter method described in IEST RP-CC007.2," said Philip Winters, Chair of WG-CC007. "The inclusion of the Type H through K filters in these RPs is a step toward merging the different test standards that are currently in use around the world. This is especially important for HEPA and ULPA testing, since these markets are global in nature."

New to this edition is an informational appendix that describes considerations for evaluating specific media types, such as membranes and electrostatically charged media. Another new appendix covers particle detection and particle size distribution. "The audience for this RP includes everyone from filter manufacturers to end users," noted Winters.

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