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Standard Test Method for Determination of Total Hydrocarbon Contribution by Gas Distribution System Components [1]

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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 covers the testing of components for total hydrocarbons (THC) contribution to a gas distribution system at ambient temperature. In addition, this test method allows testing of the component at elevated ambient temperatures as high as 70°C.

1.2 This test method applies to in-line components containing electronics grade materials in the gaseous form, such as those used in semiconductor gas distribution systems.

1.3 *Limitations*:

1.3.1 This test method is limited by the sensitivity of current instrumentation, as well as by the response time of the instrumentation. This test method is not intended to be used for components larger than 12.7-mm (½-in.) outside diameter nominal size. This test method could be applied to larger components; however, the stated volumetric flow rate may not provide adequate mixing to ensure a representative sample. Higher flow rates may improve the mixing but excessively dilute the sample.

1.3.2 Different instrumental methods (such as flame ionization detector (FID), mass spectrometer (MS)) will yield total hydrocarbon (THC) levels that are not comparable due to different sensitivities to different molecular species. Hydrocarbon contaminants of high-purity gas distribution systems can be subdivided into two general categories: (*1*) noncondensable hydrocarbons ($<C_4$), that are present due to difficulty of removal and relative atmospheric abundance, and (*2*) condensable hydrocarbons, that are often left behind on component surfaces as residues. Condensable hydrocarbons include pump oils, degreasing agents, and polishing compound vehicles.

1.3.3 Because of the tremendous disparity of hydrocarbon species, it is suggested that direct comparisons be made only among data gathered using the same detection method.

1.3.4 This test method is intended for use by operators who understand the use of the apparatus at a level equivalent to six months of experience.

1.4 The values stated in SI units are to be regarded as the standard. 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 5.

2. Terminology

2.1 *Definitions:*

2.1.1 *baseline*—the instrument response under steady state conditions.

2.1.2 *glove bag*—an enclosure that contains a controlled atmosphere. A glove box could also be used for this test method.

2.1.3 *heat trace*— heating of component, spool piece, or test stand by a uniform and complete wrapping of the item with resistant heat tape.

2.1.4 *methane (CH_4)* equivalent—that concentration of CH_4 that causes the same instrument response as the sample.

2.1.4.1 *Discussion*—The calibration gas contains a known concentration of methane (CH_4). Instrument response to zero gas and span gas defines the calibration curve for the analyzer. Instrument response to the sample is the summation of the response for each hydrocarbon reaching the detector. The concentration reported is the methane concentration, from the calibration curve that corresponds to the instrument response to the sample. The sample's concentration is equivalent to the methane concentration that would produce the same instrument response.

2.1.5 *minimum detection limit (MDL) of the instrument*—the lowest instrument response above zero detectable that is

[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.

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