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Techniques for Suspect/Counterfeit EEE Parts Detection by Fourier Transform Infrared Spectroscopy (FTIR) Test Methods

RATIONALE

This document was created to provide guidance for those unfamiliar with Fourier Transform Infrared (FTIR) spectroscopy towards its application of counterfeit detection of electronic components. Additionally, this document is intended to provide guidelines for the application of FTIR spectroscopy and to define the compliance requirements for laboratories using this technique.

INTRODUCTION

Fourier transform infrared spectroscopy is used to obtain infrared spectra of materials which are akin to “fingerprints” allowing for materials identification and verification. In the context of counterfeit detection this method could allow for the determination that the proper class of encapsulation, polymer, lettering, coating, etc., is applied to components under investigation. This will be particularly useful when known authentic parts are available for comparison purposes. This method could also be applied to detect foreign materials such as blasting beads used to alter parts. Solvent extractions of Device Under Test (DUT) could also indicate if parts had been exposed to cleaners or other materials used during part alteration.

FTIR spectroscopy is more universal than many analytical techniques and allows for the analysis of a variety of compounds including both organic and inorganic materials. Single-bounce Attenuated Total Reflectance (ATR) crystals allow for analysis of samples of about 200 microns diameter and larger, while the use of FTIR microscopy extends this down to the diffraction limit of about 10 microns diameter. Thin films can also be analyzed using techniques such as grazing angle reflectance; however, this approach would be limited to samples that are amenable to such investigations.

In theory all infrared active materials produce unique spectra leading to the fingerprint analogy. In this regard databases of a wide variety of materials are available for matching purposes. Also, reference spectra of known authentic parts can be compared to DUT spectra. Pass/Fail criteria can be established using a variety of techniques.

Although FTIR microscopy can extend to a diffraction limit of about 10 microns, in most cases, as will be outlined herein, FTIR spectroscopy is a bulk analysis technique. That is, the spectrum that is created is a weighted average of all materials present. As a result, analysis of mixtures can be complicated and detection of trace components difficult to impossible. Also, in many cases, for example with regards to polymer characterization, identification of chemical class is generally straight forward while identification of slight variants within a class is much more tedious, if possible at all.

While most materials are accessible using FTIR spectroscopy, some are not. An example is carbon black which is a common additive that is essentially IR opaque. This can hinder the analysis of carbon filled materials. Other materials including many inorganic salts and metals are not detectable by infrared spectroscopy.

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