



ANALYSIS via FTIR

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Typical Uses

- Contamination (Residue) Analysis
- Plastic Identification
- Rubber Pyrolyzate Identification

Introduction:

Fourier Transform Infrared Spectroscopy (FTIR) is a standard technique used in the identification of contaminating materials on the surface of printed circuit boards (PCBs) and around the leads of electronic components (BGA, capacitors, resistors, inductors, connectors, diodes, oscillators, transformers, IC, etc.) on printed circuit assemblies (PCAs). Additionally, FTIR can be used for “simpler” identifications, such as determining a specific type of plastic or rubber compound.

Infrared spectra obtained via FTIR can help in identifying the chemical composition and / or bonding present in an unknown molecule. The greatest use of infrared spectroscopy is that the tool provides structural information about the presence of certain functional groups that are present in a sample.

Methodology:

A Fourier Transform Infrared Spectrometer collects and processes infrared wavelength absorbances or transmissions into spectra. These spectra are created when a molecule converts

infrared radiation into molecular vibrations. These vibrational movements create bands in a spectrum that occur at specific wavelengths (cm^{-1}). Each wavelength is then further dependent on a number of other issues that can be used to help identify which types of bonds are present in the test specimen.

Depending on the types of chemical bonds present in the specimen, the radiated light will be absorbed, transmitted, or reflected at the various wavelengths. From the spectrum produced by the sample, information about the specific bonding present is obtained from the location of group frequency peaks, typically located above $\sim 1500 \text{ cm}^{-1}$. Group frequency peaks are typically strong in intensity and convey the presence of numerous organic functional groups. These include, but are not limited to, alcohols (-O-H), amines (-N-H), carbonyls (-C=O), etc.

Additionally, most sample spectra will also contain additional “fingerprint” peaks, located below $\sim 1500 \text{ cm}^{-1}$, that are unique to a particular molecular structure. These peaks in the fingerprint region are typically used to differentiate between two molecules that otherwise have very similar structures. The “fingerprint” region is different even when comparing two molecules with identical group frequency peaks.

Figure 1, below, shows an example of a spectrum obtained from the FTIR with the functional group peaks located to the left end and the “fingerprint” peaks located to the right end of the scan.

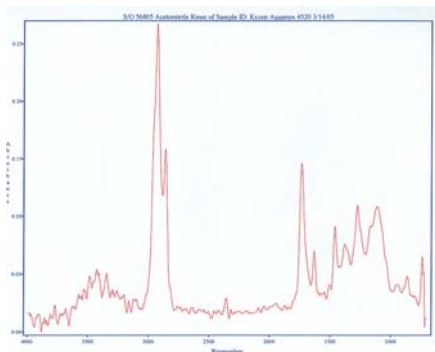


Figure 1 – Example of an FTIR Spectrum

Moving back to the analysis side of FTIR, the spectrometer has the ability to analyze samples in two distinctly different ways. These analysis methods are referred to as “bench” and “micro-FTIR”.

A “bench” analysis generally consists of forming the specimen to be analyzed into a thin film or pellet and then passing the infrared beam through the sample to obtain a spectrum. Typically, this type of analysis is performed on homogenous samples.

A “micro-FTIR” analysis consists of using a microscope attachment on the spectrometer to analyze areas of interest as small as 25 microns in diameter. This technique is particularly useful in analyzing small areas of surface contamination or evaporated rinse solutions. Also, “micro-FTIR” allows for in situ analysis of samples if needed.

After obtaining an FTIR spectrum, the scan can then be interpreted to provide information about the compound(s)

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present in the test specimen. In most cases, the spectrum can be compared with spectra of standard materials from an IR reference library or compared with customer-supplied references. Either way, the spectrum gives a significant amount of information about the sample and sometimes even the relative amount present.

Image 1, below, shows an overview of the FTIR with the microscope attachment for performing “micro-FTIR” analysis shown to the far right in the picture.



Image 1 – Overview of FTIR Unit

Analysis Results:

Overall, FTIR can be used as an extremely effective tool for many analyses.

For contamination analyses, FTIR can typically determine the source of an observed contaminant, while for identification analyses; FTIR can distinguish between types of plastics, such as PVC and PP, and between types of rubbers such as natural rubber and butyl rubber.