How Does FTIR Work?

February 1, 2015 by Jennifer Mathias – Leave a Comment

Introduction to FTIR

FTIR Analysis measures the infrared region of the electromagnetic radiation spectrum, which has a longer wavelength and a lower frequency than visible light, and is measurable in a sample when submitted to infrared radiation (IR). The basic theory at work is that the bonds between different elements absorb light at different frequencies.

The light is measured using an infrared spectrometer which produces the output of an infrared spectrum. The IR spectrum is a graph of infrared light absorbance by the substance on the vertical axis and the frequency (wavelength) on the horizontal axis.

FTIR Service Details

Find out if FTIR Analysis is Right for Your Application

How FTIR Works

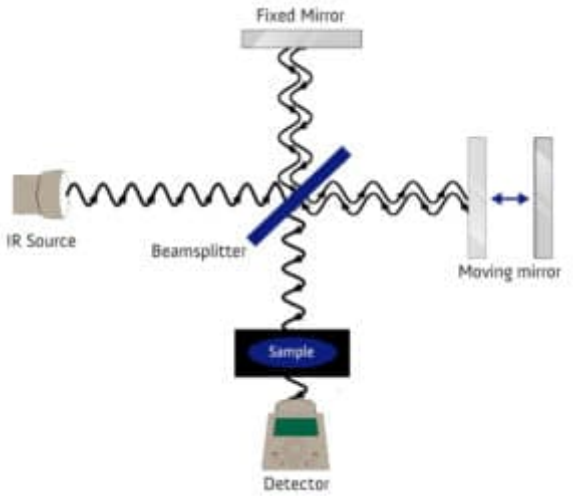
FTIR analysis measures the range of wavelengths in the infrared region that are absorbed by a material. This is accomplished through the application of infrared radiation (IR) to samples of a material. The sample's absorbance of the infrared light's energy at various wavelengths is measured to determine the material's molecular composition and structure.

Unknown materials are identified by searching the spectrum against a database of reference spectra. Materials can be quantified using the FTIR materials characterization technique as long as a standard curve of known concentrations of the component of interest can be created.

FTIR Analysis can be used to identify unknown materials, additives within polymers, surface contamination on a material, and more. The results of the tests can pinpoint a sample's molecular composition and structure.

A simple device called an interferometer is used to identify samples by producing an optical signal with all the IR frequencies encoded into it. The signal can be measured quickly.

Then, the signal is decoded by applying a mathematical technique known as Fourier transformation. This computer-generated process then produces a mapping of the spectral information. The resulting graph is the spectrum which is then searched against reference libraries for identification.



With the microscope attachment, samples as small as 20 microns can be analyzed. This allows quick and cost effective identification of unknown particles, residues, films or fibers. FTIR testing can also measure levels of oxidation in some polymers or degrees of cure in other polymers as well as quantifying contaminants or additives in materials.

Testing Process

- **Step 1:** Place sample in FTIR spectrometer. The spectrometer directs beams of IR at the sample and measures how much of the beam and at which frequencies the sample absorbs the infrared light. The sample needs to be thin enough for the infrared light to transmit through, or a thin slice of the material must be removed. Reflectance techniques can be used on some samples and no damage is done to the sample. Samples conducive to reflectance are residues, stains or films on a fairly flat reflective surface or somewhat pliable materials that are thin enough to fit under the microscope using the attenuated total reflectance attachment to the microscope.
- **Step 2:** The reference database houses thousands of spectra, so samples can be identified. The molecular identities can be determined through this process.

FTIR Sampling

Samples as small as 10 microns can be evaluated using FTIR analysis. The tiny sample size allows for cost effective identification of particles, residues, films or fibers. FTIR analysis can also measure levels of oxidation or degrees of cure in some polymers as well as measuring the level of contaminants or additives.

Learn more about FTIR Sampling Techniques.

- Overview of FTIR Spectroscopy
- FTIR Applications and Service Details
- FTIR Resources and Learning Materials
- FTIR Sampling Techniques

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