

Applications of FTIR

Novel applications of hand-held and benchtop
FTIR instruments





FTIR Spectroscopy Offers a Wide Range of Analytical Opportunities

Fourier transform infrared (FTIR) spectroscopy is a well-established and powerful instrumental technique providing detailed spectra of a wide variety of samples. Even though FTIR is a mature technology, advances in handheld instruments and sampling interfaces offer greater flexibility. In-situ and non-contact measurements are now quick and easy.

Agilent FTIR spectrometers

We offer a wide range of FTIR instruments, from robust handheld systems for field analysis to highly sensitive benchtop imaging systems.

4300 Handheld FTIR

The 4300 Handheld FTIR is the first of its kind to employ lightweight ergonomics, ease of use, ruggedness, and flexibility into one system. The 4300 weighs approximately 2 kg, making it ideal for field use and deployment into non-laboratory situations.



Cary 630 FTIR Spectrometer

The benchtop Agilent Cary 630 FTIR spectrometer is versatile, innovative, and intuitive, providing quantitative and qualitative information for routine analysis of solids, liquids, and gases.



Paints

Fourier transform infrared (FTIR) instruments are replacing dispersive infrared instruments in the coatings industry because FTIR is much faster, more accurate, and more sensitive. Modern data processing capabilities also make FTIR valuable in identifying and quantifying chemical components in paints. Applications include problem solving, cure-level and weathering studies, and quality control. Two examples follow.

Quantifying the A:B mix ratio of a 2K Industrial OEM PU paint, before autoclave thermal activation

A handheld Agilent 4300 FTIR instrument and a multivariate calculation model were used to accurately and quickly quantify the component wet mix-ratio of a paint. The paint had been applied onto an aluminium coupon using a spray gun. Spectra from the same instrument could also be used to identify paint component storage, delivery, or compositional errors.

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Identifying paint formulations

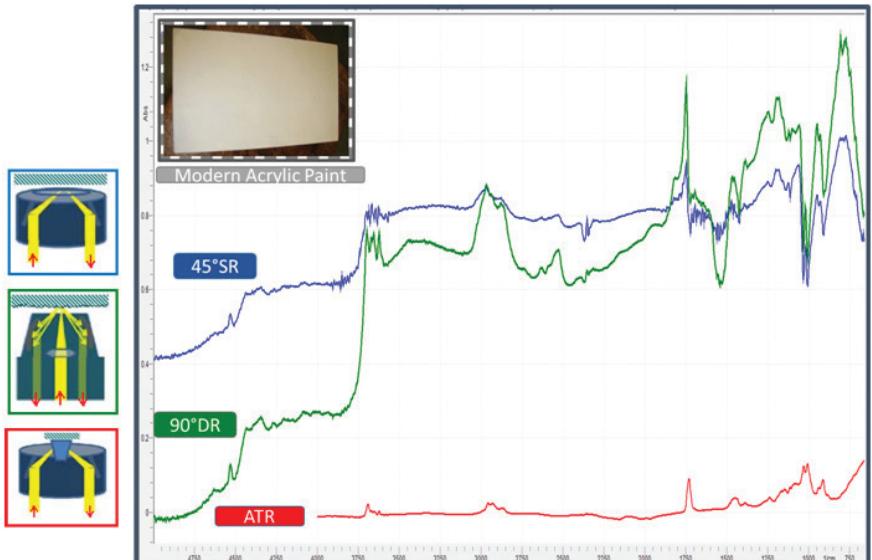
A study of 14 different formulations of a white acrylic paint compared spectra collected with an Agilent 4300 handheld FTIR spectrometer, in the following modes:

- Attenuated Total Reflection (ATR)
- 45° Specular Reflection
- Diffuse Reflectance

As this figure shows, the diffuse reflectance measurements yielded the most detailed spectrum. The paint formulations could be identified from the diffuse reflectance spectra.

Diffuse reflectance can be measured without applying force to the sample surface and has also been used to study the weathering of paint, in-situ.

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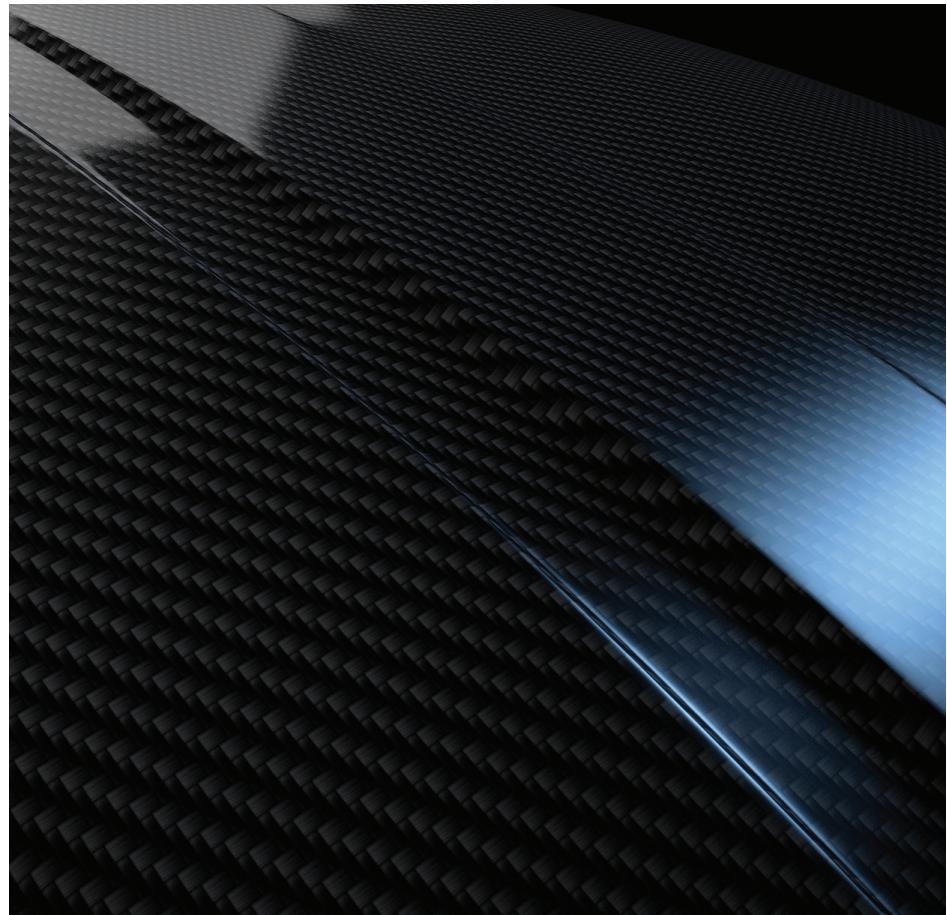


Polymers

Release agents are applied as a liquid to form a thin film coating, aiding removal of carbon-fiber-reinforced polymer (CFRP) parts from a mold or peel ply. This process can lead to inevitable contact transfer, causing release agent to remain on the part. Retained release agent can lead to reduction of bond strength of joined parts or poor topcoat paint adhesion.

An Agilent handheld FTIR was used to quantify the release agent on a carbon-fiber reinforced polymer. This nondestructive, in-situ analysis was completed in less than one minute.

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Concrete

Measuring composition and cure level

Handheld FTIR has been successfully used for the nondestructive analysis of geopolymer cement, effectively monitoring changes in composition and chemistry during cure.

The technique can also be used to differentiate between concrete blend types. It can even monitor the changes of these blends as a function of thermally induced chemical and physical changes and can correlate this to loss of strength.

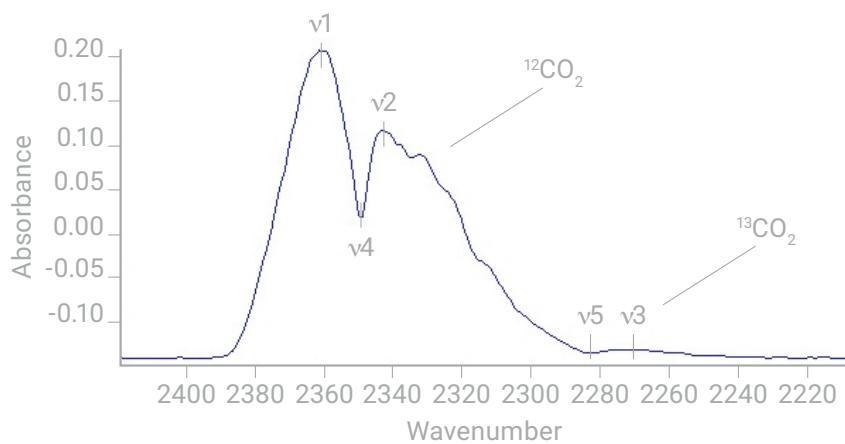
[Download an application note that includes the use of FTIR for concrete analysis](#)

Environmental Samples

In-Situ $^{13}\text{C}/^{12}\text{C}$ Ratio Analysis in Water Carbonates

A study investigated the use of FTIR spectroscopy for the analysis of environmental carbon isotopes. The results were compared against those obtained using quadrupole mass spectrometer, the standard method for the measurement of carbon isotopes. The difference between the results of the FTIR method and those measured with the MS method was only 1.87% in δ values, which is acceptable in most environmental processes.

Download the full application note



The FTIR analysis of CO_2 yields a peak between wavenumber 2,240 to 2,385 cm⁻¹ which contains the two isotopes: $^{12}\text{CO}_2$ and $^{13}\text{CO}_2$.

Screening Drug Samples

A study used an Agilent 630 FTIR and 4500 handheld FTIR to develop an automated screening method for cocaine identification in seized drug samples.

The non-destructive method used a peak picking mathematical algorithm. This algorithm could successfully identify cocaine, independent of the adulterants or diluents present in the sample. Cocaine concentrations as low as 6% by weight were able to be identified. Analysts of varying experience levels were able to successfully use the method. This included law enforcement personnel in two European countries.

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Geological Samples

Three sample measurement techniques were used to measure a geological monolithic silica based ore rock fragment, using a hand-held Agilent 4300 FTIR instrument.

The diffuse reflectance FTIR technique yielded spectra with enough detail to use for identification of minerals in the sample. Spectra could be collected in-situ, using a point-and-shoot method.

[Download the full application note](#)

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