6 Reasons to adopt Raman Spectroscopy

You may be familiar with FTIR spectroscopy and curious about how you can use Raman spectroscopy to complement your FTIR analysis. Consider the advantages of Raman spectral analysis below to help you solve problems and reveal new information about your advanced materials.

Raman spectroscopy is a molecular analysis technique that has been adopted by industrial, forensic, environmental, and research scientists to:

• Identify and quantify unknown materials (e.g., Forensic evidence, art restoration)

• Understand molecular structure (e.g., crystallinity, polymorphism)

• Study spatial relationships between sample components (e.g., failure/defect analysis, depth profiling)

Reasons your lab could benefit from using Raman spectroscopy

1

Save time and preserve your sample
Samples can be measured in their native form, eliminating the need for sample preparation. Raman microscopy is confocal, so depth analysis of multilayer or embedded samples can be measured without destroying the sample.

2

See and resolve smaller samples
Raman microscopy uses visible wavelengths (shorter than infrared) and is able to resolve and identify small defects and contaminants using single-point measurements or rapid imaging down to 1 micron.

3

Measure aqueous samples
With other techniques the spectroscopic interference from water can overwhelm the signal from the analyte of interest, but this interference becomes insignificant with Raman spectroscopy, allowing *in situ* measurements of wet materials such as biological tissues and cells.

4

Study carbon nanomaterials
The Raman spectrum can quickly reveal uniformity, purity, functionalization, thickness, and other properties of the symmetric bonding in 2D carbon materials such as graphene and carbon nanotubes.
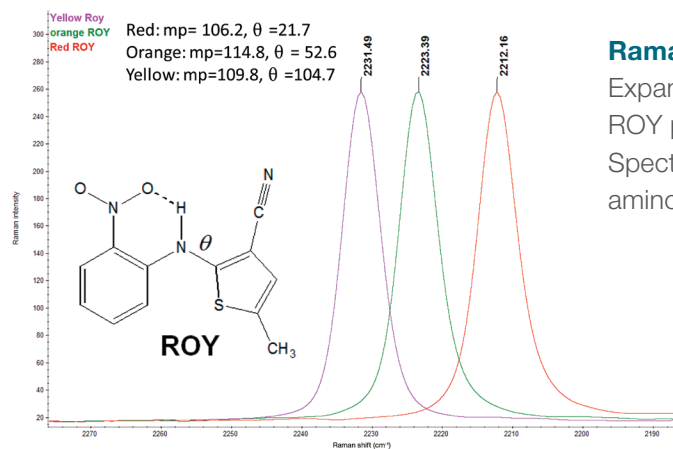
5

Measure samples through transparent containers
Since Raman spectroscopy uses lasers with wavelengths in the UV-visible region (400-700 nm), glass and quartz containers do not interfere with the Raman reading, allowing users to verify the identity of packaged materials.

6

Characterize morphology as well as chemistry
The chemical backbone, polymorph structure and degree of crystallinity can all be distinguished using Raman spectroscopy. Applying polarization to the measurements can reveal crystal orientation, making Raman spectral analysis a multifaceted tool for understanding a material's structure-function relationship.
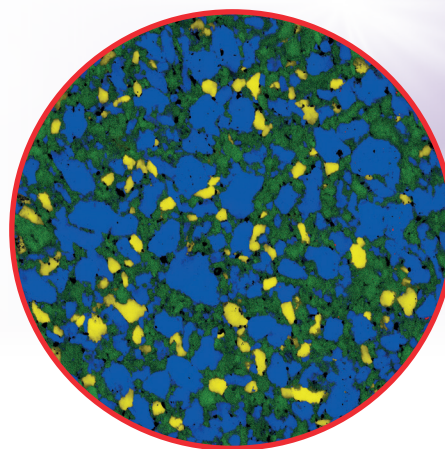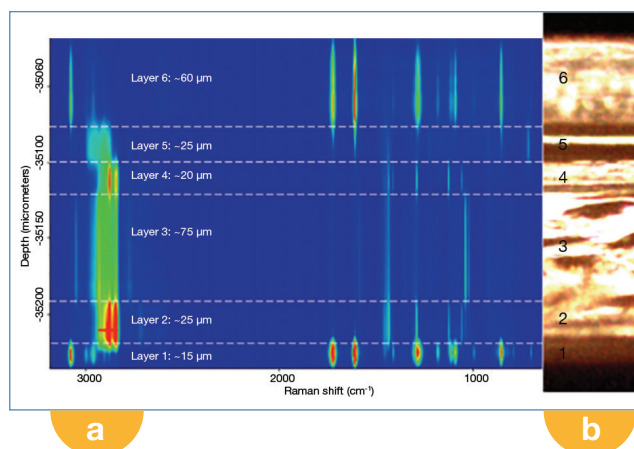

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Raman spectroscopy applications – examples

Red: mp= 106.2, θ =21.7
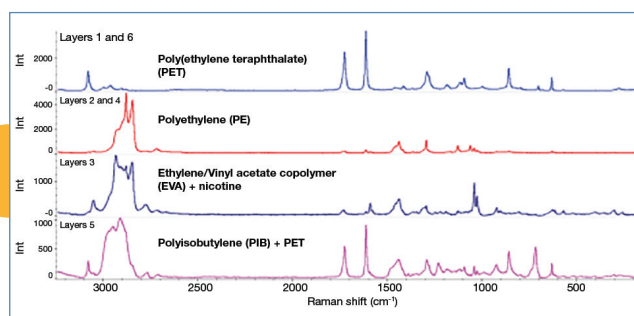Orange: mp=114.8, θ = 52.6
Yellow: mp=109.8, θ =104.7

Raman analysis of polymorphs

Expansion of the nitrile peak showing a peak shift for three different ROY polymorphs using the Thermo Scientific™ Nicolet™ iS50 FTIR Spectrometer with Raman Module. ROY = 5-Methyl-2-[(2-nitrophenyl) amino]-3-thiophenecarbonitrile.

Spatial distribution of components

Raman image of a whole pain reliever tablet (11 mm diameter) scanned in 8 minutes using the Thermo Scientific™ DXR™2xi Raman Imaging Microscope. Multivariant curve resolution (MCR) image analysis: Blue – Aspirin, Green – Acetaminophen, Yellow – Caffeine, and Red – titanium dioxide.

Confocal Raman Microscopy Depth Analysis

a) Raman line depth map (Z-map) for a transdermal nicotine patch. The dashed white lines indicate the approximate depth of each of the six layers measured with the Thermo Scientific™ DXR™2 Raman Microscope. **b)** An optical image of the cross section. **c)** Representative Raman spectra for each layer of the nicotine patch.

Learn more with these Raman spectroscopy resources:

Spectroscopy Academy – Raman at **thermofisher.com/learnraman**

Thermo Scientific™ Raman Instruments at **thermofisher.com/raman**

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