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DXR3 Flex Raman Spectrometer

Research-grade Raman “engine” that adjusts to your needs!

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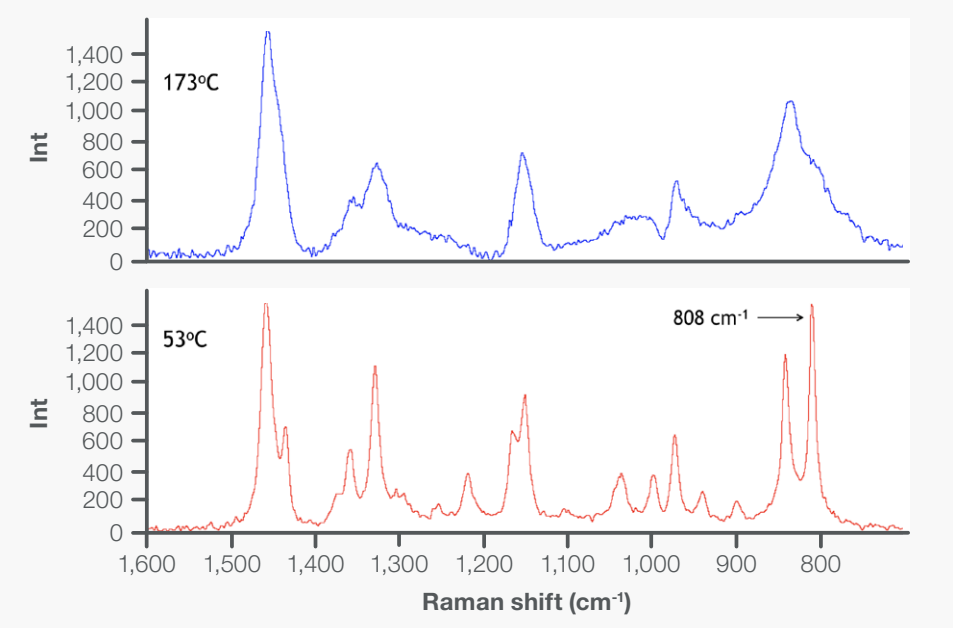
Raman spectroscopy is an extremely powerful technique utilized for research and material characterization in a wide variety of fields such as semiconductors, pharmaceuticals, electronics, polymers and environmental science. Currently, research-grade Raman analysis require samples to be brought to the lab and prepared for analysis by experts. In addition, the shapes, sizes and forms of samples that can be analyzed are limited by the sample holder and mounting stages included in the system. We set out to resolve these challenges with our compact DXR3 Flex Raman Spectrometer—a true research-grade instrument—by designing it so that the instrument can be taken close to the sample and is able to measure any kind of sample.

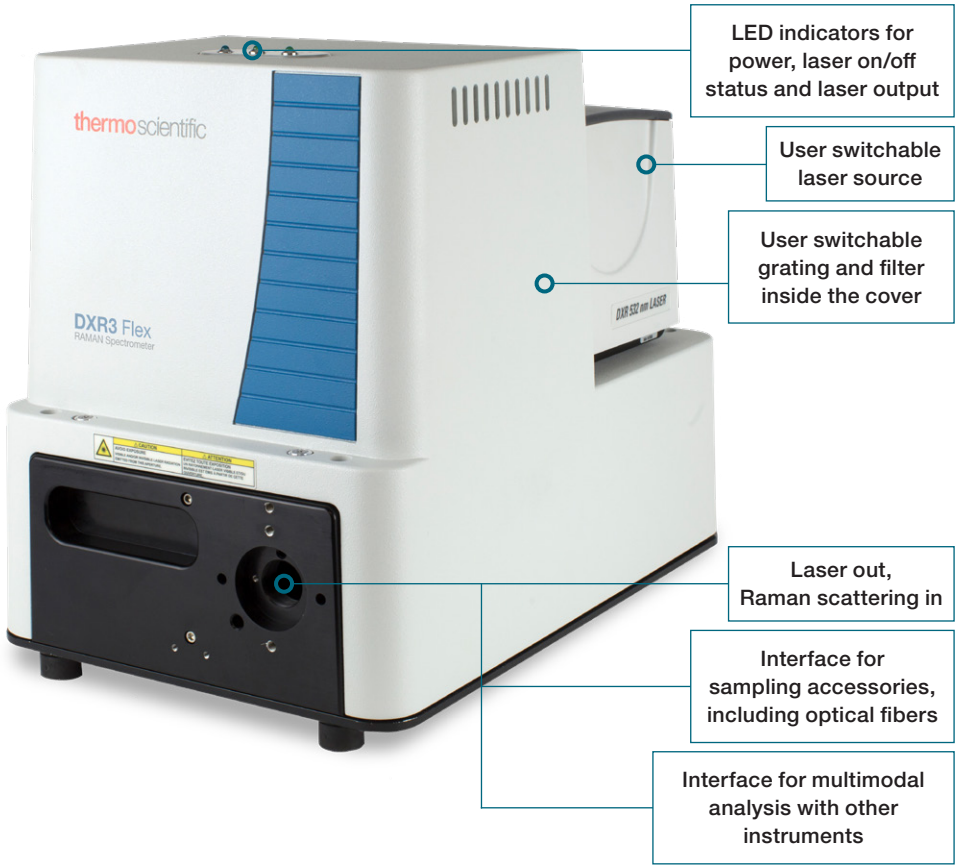
The DXR3 Flex Raman Spectrometer is also designed for multimodal analysis through seamless integration with other analytical techniques; this enhances the understanding of materials with detailed molecular-level information. With its ability to combine with rheometers, X-Ray Photoelectron Spectrometers (XPS), atomic force microscopes (AFM), and many other instruments through its open beam design, the DXR3 Flex Raman Spectrometer is suitable for demanding research, product development, and manufacturing.

Introduction

Inventions, discoveries, and scientific successes often require unconventional approaches and out-of-the box thinking. With this in mind, we have developed the DXR3 Flex Raman Spectrometer, a “Raman engine” to power your application with the flexibility you need. With the DXR3 Flex Raman Spectrometer’s ability to measure any sample size, preparing your sample to fit the sample holder is a thing of the past —simply get started with the macro sample holder, micro sample measurement attachment or fiber-optic probe, all without any sample preparation. We put an extreme focus on incorporating ease-of-use and versatility into the design of DXR3 Flex Raman Spectrometer so that you can focus on your goals and not on the operation of the instrument!



Raman spectra of the molten (top) and crystalline (bottom) states of polypropylene, measured on the DXR3 Flex Raman Spectrometer in a rheo-Raman setup. The band at 808 cm^{-1} is due to the skeletal deformation of helical chains within the crystal, and its intensity can be used as a measure of crystallinity of polypropylene.



Why Raman spectroscopy?

- Provides unique spectral fingerprint for chemical identification
- Reveals morphology and changes including phase transformation of a matrix
- Has high sensitivity to carbon nanomaterials including physical states and chemical functionalization
- Is an essential analytical tool for materials research

Applications

The “Raman engine” to power your applications

The DXR3 Flex Raman Spectrometer is a compact research-grade Raman spectrometer, the “Raman engine” that can take your Raman analysis to the next level. While the spectrometer provides the sample excitation and superb Raman measurement capabilities, its flexible design enables it to be adjusted to different types of samples and set up in almost no time.

Highlights:

1. The DXR3 Flex Raman Spectrometer provides analysis flexibility with user-exchangeable excitation sources, gratings, and filters to help avoid fluorescence – capabilities typically only found in larger-footprint Raman systems.
2. A variety of sample holders and measurement accessories overcomes the hurdles of sample size and shape limits often seen in traditional instruments. In addition, open-beam configuration of the instrument enables it to be easily outfitted with custom accessories to meet your specific needs.
3. Multimodal (hyphenated) measurements to achieve holistic characterization with simultaneous physical and chemical analysis is a simple task with DXR3 Flex Raman Spectrometer’s compact size and open-beam design.

Samples and holders of different sizes and shapes are accommodated with optical fiber probes.

Fiber-optic probes

Fiber-optic probes and process measurement

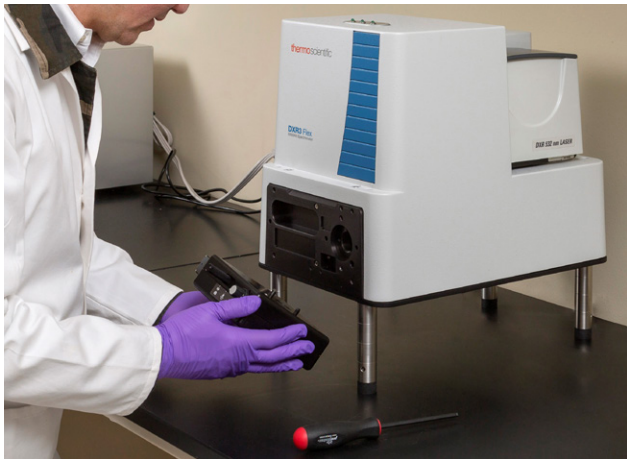
With the available fiber optic launcher accessory, the DXR3 Flex Raman Spectrometer is ready within minutes for fiber-based measurements. Whether you would like to obtain a Raman signal from solids, powders, or liquids, we’ve got you covered! In addition, monitoring of both laboratory reactions and real-time processes are easily achieved using the fiber probes.

DXR3 Flex equipped with fiber probe launcher.

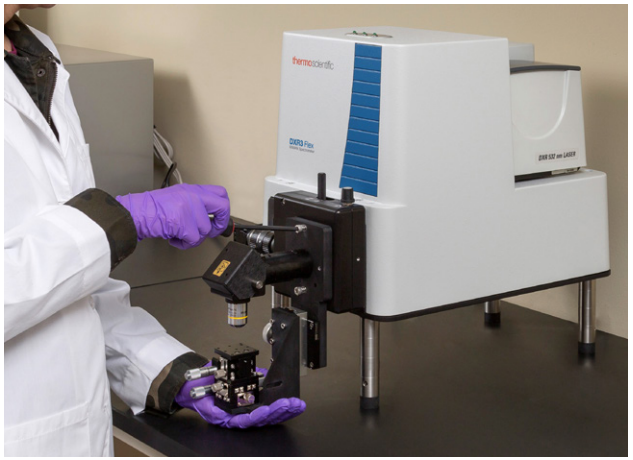
Versatility

A perfect instrument for all kinds of samples

DXR3 Flex Raman Spectrometer and accessories packed in a travel case.



DXR3 Flex Raman Spectrometer being outfitted with a user-replaceable macro sample measurement accessory for solid, liquid and powder measurements.



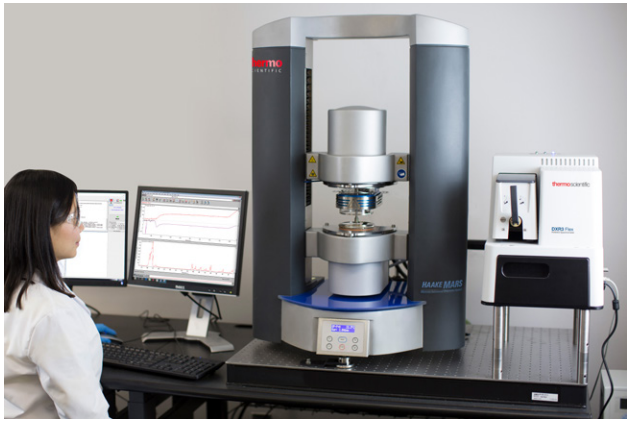
DXR3 Flex Raman Spectrometer equipped with micro-stage sampling accessory for simple point-and-shoot measurement of microscopic samples.

DXR3 Flex Raman Spectrometer equipped with a microscope accessory for art authentication analysis. This eliminates the sample size limit, and with the available lens tube to extend the reach, makes it more accessible for samples of different shapes and sizes.

Multimodal

Multimodal measurement gives the most accurate measurements

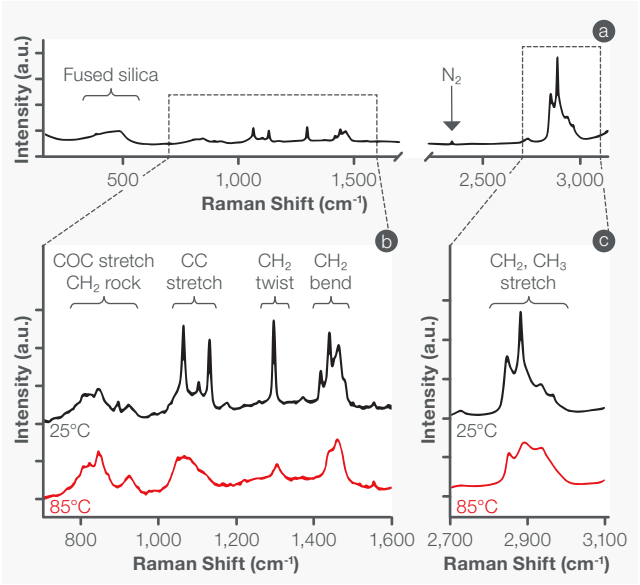
Traditional laboratory setup requires techniques to be operated separately, and samples need to be transferred between instruments. With the DXR3 Flex Raman Spectrometer's ability to seamlessly integrate with other laboratory instrumental setups, samples can be measured by two techniques (one of them being Raman) simultaneously. This eliminates the errors introduced by environmental factors, and also the need to correct data using assumptions. In addition, the time and effort needed for experiments with the multimodal setup are significantly lower than carrying out the measurements separately.



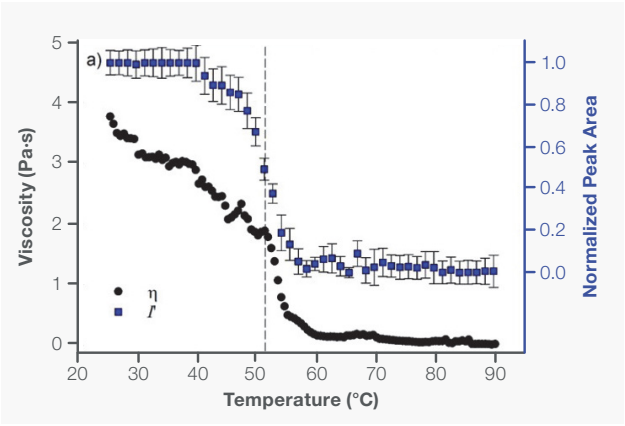
DXR3 Flex Raman Spectrometer integrated with a Thermo Scientific HAAKE™ MARS™ Rheometer

Rheo–Raman

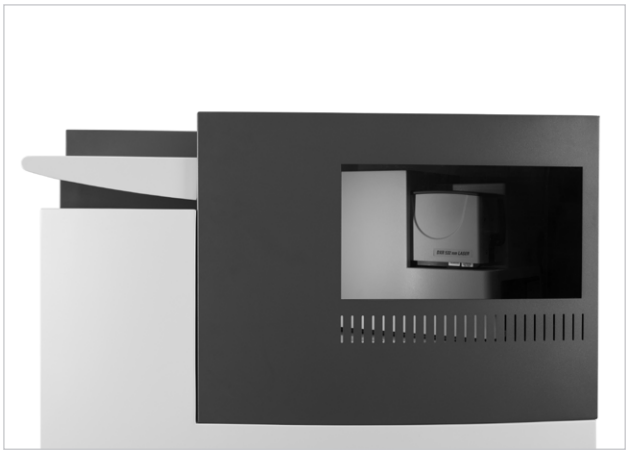
Rheology is the study of the flow and deformation of matter, ranging from fluids to solid-like materials. Rheological measurements are commonly used to examine bulk physical material changes, such as melting, crystallization, gelation, polymerization, etc. Raman spectroscopy, on the other hand, is a vibrational spectroscopic technique that can provide insights to these processes at the molecular level, both chemically and morphologically. However, traditionally, Raman spectra are acquired prior to and after the observed physical transformation. The true chemical/morphological changes driving these processes are largely left uncaptured, leaving much room for data interpretation and speculation surrounding these dynamic physicochemical relationships. With the coupling of DXR3 Flex Raman spectrometer and a rheometer, these vagaries are no longer a concern: the changes can be observed in real-time.



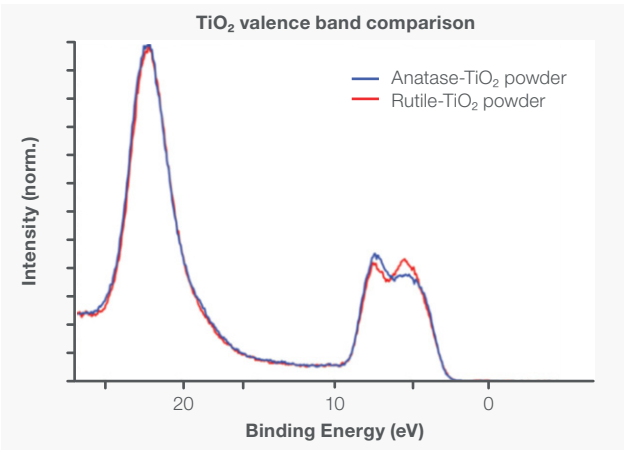
(a) Raman spectrum of the emulsion at room temperature over the instrument range. (b) Raman spectra of the emulsion in the range of (700 to 1600) cm^{-1} at temperatures indicated in the figure. (c) The same spectra collected in (b) in the (2700 to 3100) cm^{-1} region. Note that the intensity scaling varies from (b) to (c).



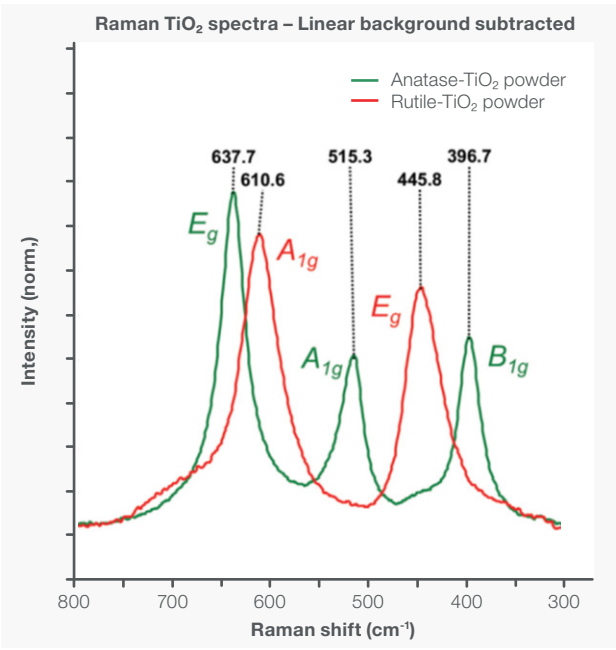
Viscosity and normalized peak area *I'* as a function of temperature for the emulsion.



Thermo Scientific DXR3 Flex Raman Spectrometer coupled to a Thermo Scientific Nexsa G2 X-Ray Photoelectron Spectrometer (XPS) System.



XPS valence band comparison – Pure TiO_2 powders.



Comparison of the Raman spectra of the pure TiO_2 powders.

XPS (X-ray photoelectron spectroscopy)–Raman

XPS is used for quantitative determination of both elemental and chemical composition for any solid material compatible with ultra-high vacuum. On the other hand, Raman spectroscopy is used for identification of referenced compounds by careful spectral matching employing searching algorithms and spectral databases. The combination of XPS and Raman on a single setup allows more powerful analysis of a material than either technique in isolation, with the cleanliness, purity and stoichiometry of a sample determined using XPS, and identification and quantification of molecular structures determined using Raman spectroscopy. As both techniques are aligned to the same position within the vacuum system, all the time-consuming aspects of locating the same analysis point when transferring the sample between instruments is removed, giving absolute certainty that the information acquired has all come from the same parts of the sample. This is particularly useful when studying non-uniform samples.

Hyphenate your own instrument with the DXR3 Flex Raman Spectrometer!

Obtain an excellent Raman signal for multimodal analysis with free-space coupling. Combine your own instrument with the DXR3 Flex Raman Spectrometer, such as a light microscope, or use custom-made sample holders and stages to add simultaneous Raman capabilities to your setup. The free-space coupling has the clear advantage of minimum signal loss over more traditional fiber-based coupling, especially for Raman where the light intensity available to work with is very low.

Augmentation

Flexible research-grade instrument to meet your laboratory needs

Make DXR3 Flex Raman Spectrometer part of any optical table! Simply add the lens tubes and optical mirror to extend the reach and integrate into your setup with ease.

Open-beam design.

Exchangeable lasers, filters, and gratings adapt the instrument to a wide range of material types

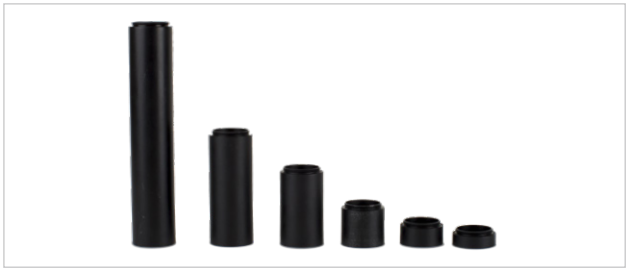
Free-space optical coupling to maximize throughput and sensitivity

Open architecture allows custom coupling to almost any equipment in any position

Fully automatic alignment and calibration ensure consistent performance and data fidelity

Proven technology for polymers, pharmaceuticals, and materials science research

Platform design offers component, software, and data compatibility with the rest of the Thermo Scientific DXR3 Raman family



Lens tubes – 6”, 3”, 2”, 1”, 0.5” and 0.3” left to right.

90° flat mirror – Coated for maximum reflectivity.

Camera accessory – Visible camera for sample inspection.
Can be used in conjunction with other sampling accessories.

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Summary

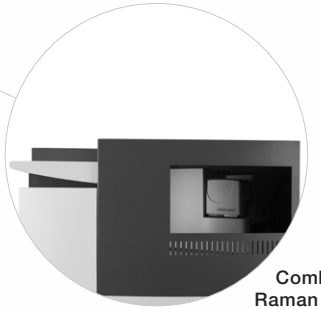
DXR3 Flex Raman Spectrometer – the “Raman engine” to power your applications!

Use it as micro-Raman analyzer with the accessory for analysis of contaminants, impurities and layers in samples such as large paintings, polymers and pharmaceutical tablets.

Combined rheology and Raman analysis.

Use it as macro-Raman analyzer with the accessory for analysis of solid samples and samples in vials, bottles and cuvettes.

Optic-fiber-based analysis for easy measurements, as well as laboratory-process and reaction monitoring.



Combine XPS with Raman analysis.

Obtain excellent Raman signal for multimodal analysis with free-space coupling. Combine your own instrument, such as a light microscope, custom-made sample holders and stages, AFM, rheometer and XPS to add simultaneous Raman capabilities to your setup.

The DXR3 Flex Raman Spectrometer is a class 3B laser product.

Learn more at **thermofisher.com/flex**

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