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# iXR Raman spectrometer

for multi-modal analysis



The Raman spectrometer developed specifically for integration with other analytical tools.

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# iXR Raman Spectrometer

Welcome to the world of Raman multi-modal analysis

The pressure to develop more competitive materials faster is growing. Holistic characterization that reveals relationships between a material's chemistry and physical properties can accelerate these developments. Such characterization is enabled by multi-modal analysis in which multiple measurement modalities are used on a single sample.

The Thermo Scientific™ iXR™ Raman spectrometer was designed specifically for integration and multi-modal analysis with other analytical techniques. Multi-modal analysis with the iXR enhances the understanding of materials by providing detailed molecular level information. With performance comparable to laboratory research grade Raman spectrometers, it is suitable for demanding research, product development, and manufacturing needs.

## Why Raman spectroscopy?

- Provides unique spectral fingerprint to enable chemical identification
- Reveals morphology and changes including phase transformations of a matrix
- Highly sensitive to carbon nanomaterials, their physical states, and chemical functionalization
- An essential analytical tool for materials research

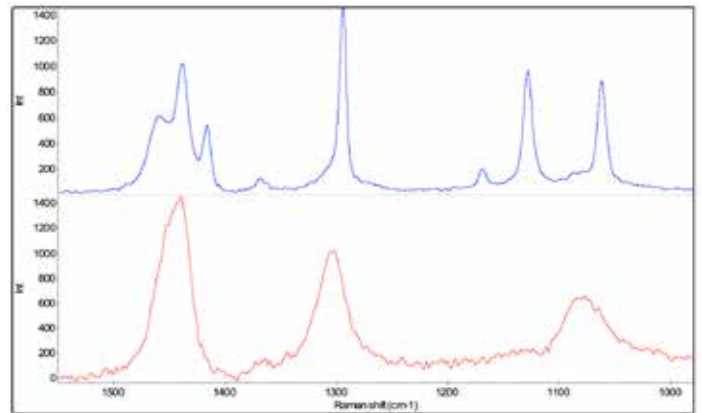




### Why Raman multi-modal analysis?

- Allows same point, same time measurements alongside primary or complementary measurement
- Measures under exactly the same conditions ensuring confidence in correlation
- Helps to establish cause-and-effect relationship between a material's chemistry and its properties
- Eliminates time consuming and difficult secondary measurements

Combining other techniques with Raman is of growing interest because of its ability to provide a chemical fingerprint, without sample preparation, and with simple optical interfacing. The iXR provides Raman spectroscopy interfacing *in-situ* with other analytical measurements. It adds chemical information about a sample collected at the same time and place as other techniques, allowing correlation and saving time. The correlated data can improve materials understanding, and in turn improve the strength of publications, enable new product improvements, facilitate failure analysis, and accelerate the engineering of new materials.



*Raman spectrum of polyethylene recorded on the rheometer at 30°C (top, blue), showing its crystalline state, and the molten state at 150°C (bottom, red). The Raman spectrum is sensitive to the physical state of a material, and can be used to track a material through its phase transitions.*



# Establish the link between the structural and physical performance

## iXR for product development and engineering

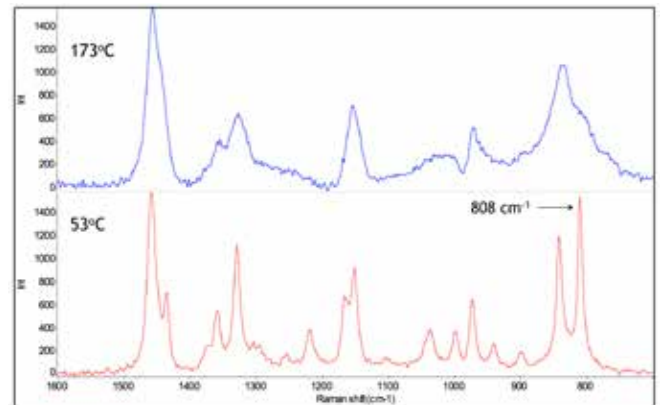
Developing and advancing today's products is increasingly challenging due to competitive pressure, and exciting thanks to the availability of new materials and tools. Engineering products to have new performance and properties requires an edge, and that can come from improved understanding of relationships between properties and states. Raman spectroscopy reveals not only chemical composition; its ability to reveal sample matrix morphology allows it to measure phase transition at a molecular level. By simultaneously measuring the Raman spectrum and mechanical, thermal, or other physical properties, strong cause-and-effect relationships can be established. Structure-property relationships are critical to performance and coupling Raman spectroscopy to physical measurements provides insight that can improve product performance and manufacturing processes, without the trial and error of separate measurements under separate conditions.

### Couple the iXR Raman to:

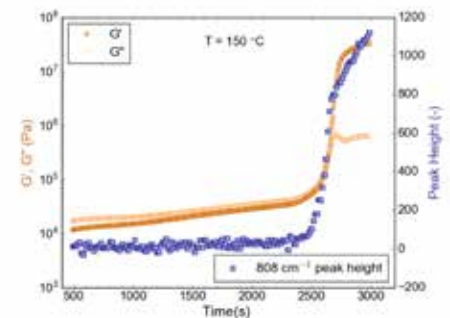
- Rheology
- Hot Melt Extrusion
- Lab and manufacturing scale processing equipment

### Improve understanding of:

- Polymers, pharmaceuticals, personal products



Raman spectrum of the molten (top) and crystalline (bottom) states of polypropylene, measured on the MARS<sub>XR</sub> Rheo-Raman system during a rheological measurement. The band at 808 cm<sup>-1</sup> 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.



Shear storage modulus ( $G'$ ), shear loss modulus ( $G''$ ) and the 808 cm<sup>-1</sup> Raman shift peak height as a function of time during the isothermal recrystallization of polypropylene measured on the MARS<sub>XR</sub> Rheo-Raman system.  $G'$  and  $G''$  were obtained from the Thermo Scientific™ HAAKE™ MARS™ rheometer, and the 808 cm<sup>-1</sup> peak height was determined from the iXR Raman spectra.



MARS<sub>XR</sub> RheoRaman System

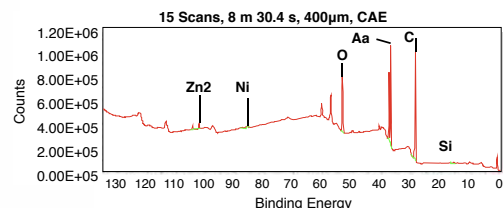




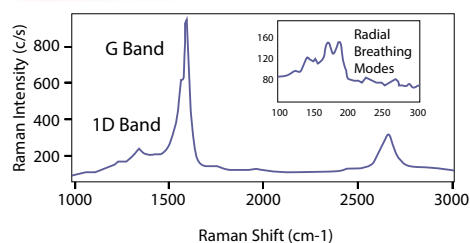
# Combine chemistry with elemental and physical insights

## iXR Raman spectrometer for materials science and advanced materials

As Materials Science and Characterization advances, both industry and academic researchers need to understand more about their materials, in greater depth, and in less time. Many analytical tools provide a fundamental view of primary physical characteristics of a material – but don't provide accompanying chemical information. A surface technique may provide elemental insights, topography, or mechanical, thermal or electrical magnetic properties but what's happening at a molecular level is an essential piece of information often missing or difficult to measure. The rise of Raman spectroscopy as an essential technique for characterizing pure carbon nanomaterials such as graphene and nanotubes, makes it a perfect choice for coupling to established standard techniques used to study solid materials.



Name	Atomic %
C	76.0
O	16.8
Ag	4.9
Si	1.3
Zn	0.5
Ni	0.4



XPS spectrum of single wall carbon nanotubes (SWCNT), top, showing the elemental composition and elemental electronic states, and the Raman spectrum, third from top. The position and intensities of the G and D bands in the Raman spectrum inform the materials scientist on the diameter, number of carbon layers, and purity of the SWCNT, simultaneous to collection of the XPS data, to assure the scientist that the same sample in the same chemical state is being measured by the two techniques.



Thermo Scientific™ Theta Probe XPS Spectrometer with iXR Raman Spectrometer installed.

# iXR Raman Spectrometer

Research Raman where you need it



**Exchangeable** lasers, filters and gratings provide adaptability to a wide range of material types

**Free-space optical coupling** to maximize sensitivity

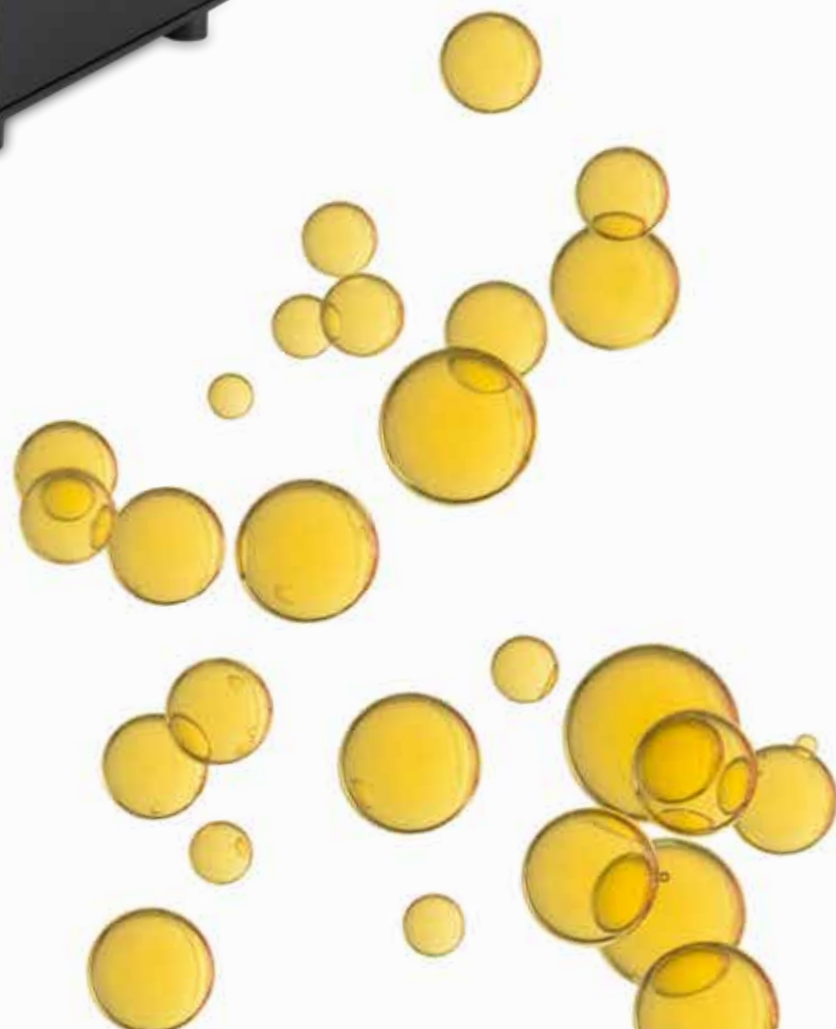
Open architecture allows **custom coupling** to almost any equipment in any position

Fully **automatic alignment and calibration** ensures all systems are ready to go and perform consistently

**Proven technology** in polymers, pharmaceuticals, and materials science research globally

Designed from **research instrument** components with easy coupling to other instruments and equipment

Platform design offers **components, software and data compatibility** with the rest of the Thermo Scientific XR Raman family

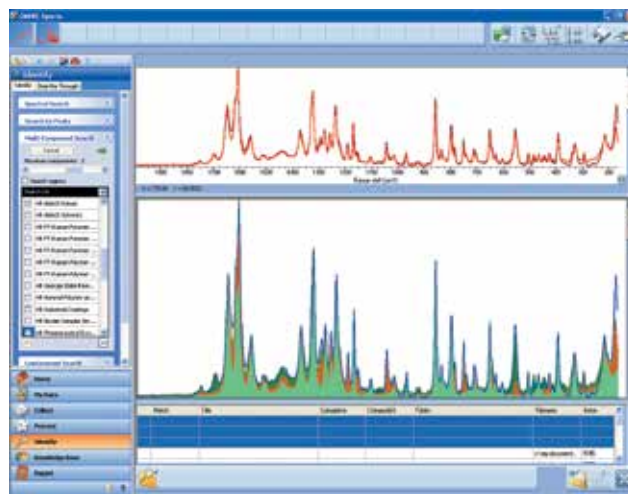




**Shareable components** for wavelengths and resolutions allow configurability to be shared across instruments, reducing costs and increasing research flexibility

**Global support** from a team of world-class service engineers and application scientists ensure you will be supported no matter where you are in the world

**Thermo Scientific™ OMNIC™ software** across the XR Raman and Thermo Scientific™ Nicolet™ FTIR product portfolio makes it easy for users, methods, and data to move from one instrument to the other



*Thermo Scientific OMNIC Spectra multi-component search identified unknown materials even in mixtures*

# XR Raman platform

## Increase productivity with shared technology for your organization

The iXR Raman is designed for interfacing to other instruments and equipment, and complement measurements or processes with high quality, real-time molecular information. But its platform design offers something substantially more – hardware, software, and data compatibility with the rest of the Thermo Scientific XR Raman family. We've designed our Raman products from a common platform of optical and detection components and software to create high compatibility from one instrument, lab, department, or product to another.



# Thermo Scientific XR Raman family

Discover. Solve. Assure.

Built on a common platform, the Thermo Scientific™ XR Raman family is designed to empower your organization to discover new materials, solve analytical problems and assure product quality. Thermo Scientific XR Raman family users can easily collaborate, deploy analytics, and solve problems across a large lab or an entire organization.

## DXR2xi Raman imaging microscope

Ultra fast chemical imaging



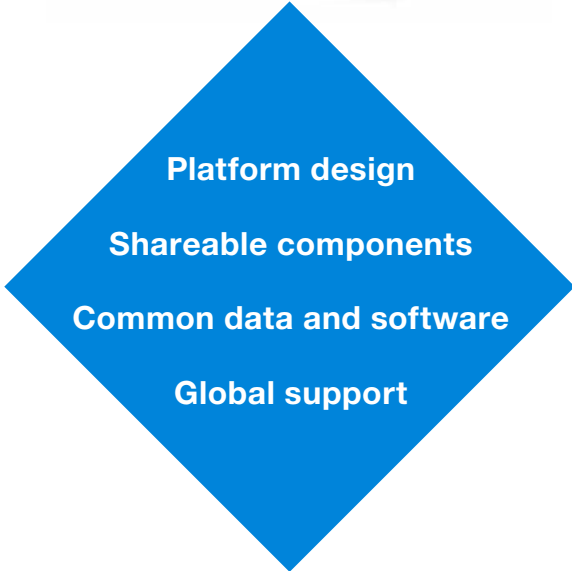
## iXR Raman spectrometer

The first Raman spectrometer designed for multi-modal analysis



## DXR2 Raman microscope

High spatial resolution imaging and point and shoot analysis



## DXR2 Smart Raman spectrometer

Bulk sample analysis for quality control

Find out more at [thermofisher.com/ixr](http://thermofisher.com/ixr)

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