

IRT-7X

Multichannel Infrared Microscope



Explore with Confidence

The IRT-7X Multichannel Infrared Microscope delivers high-definition infrared imaging with unprecedented speed, thanks to its dramatically enhanced optical observation quality and sophisticated digital processing of its high-speed linear array detector. It takes foreign object analysis and materials research—through observing, measuring, and analyzing—to the next level.

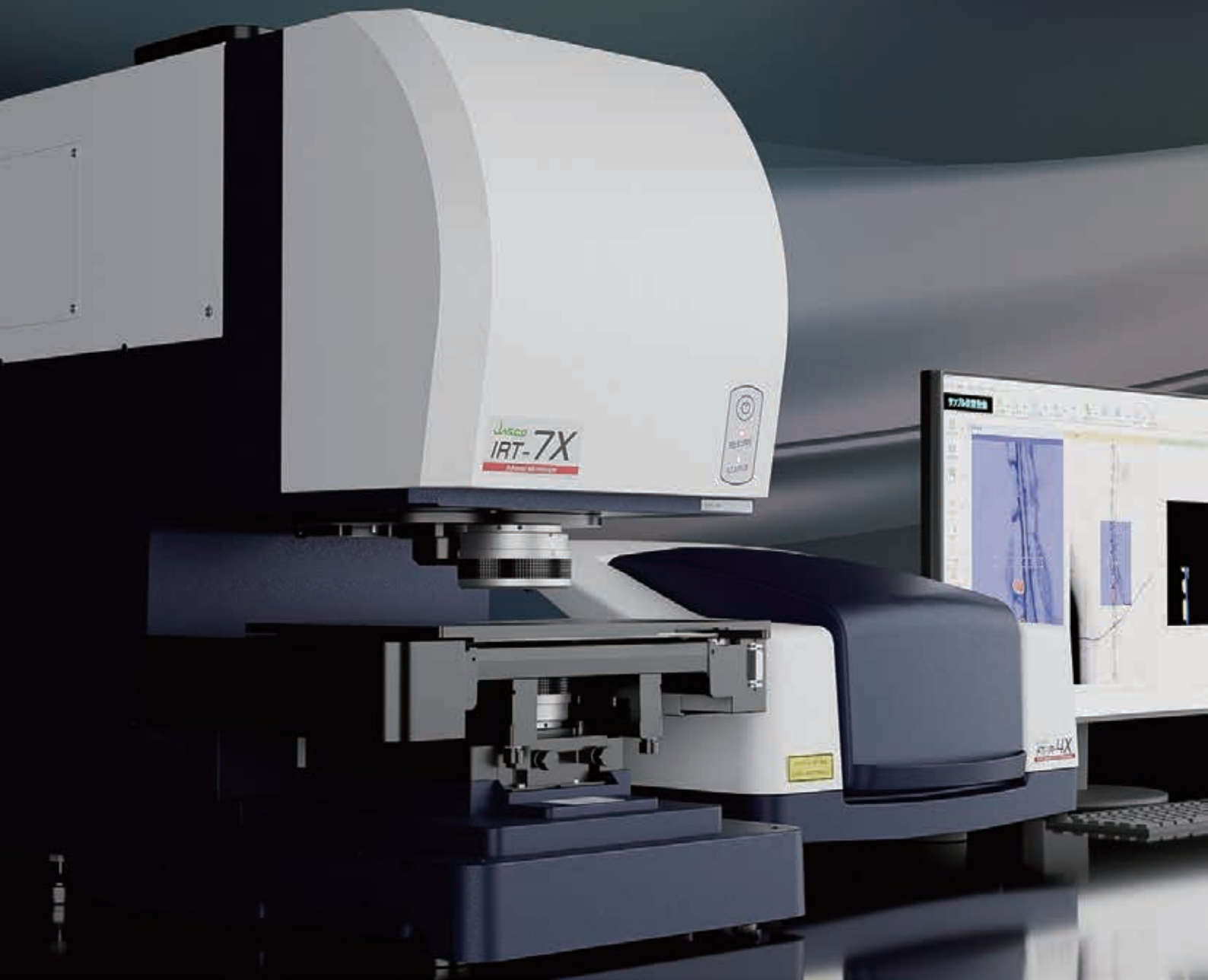
Fast IR Imaging

High-Quality Observation

Automation & Usability

Unique Innovative Technology

Various Analyses



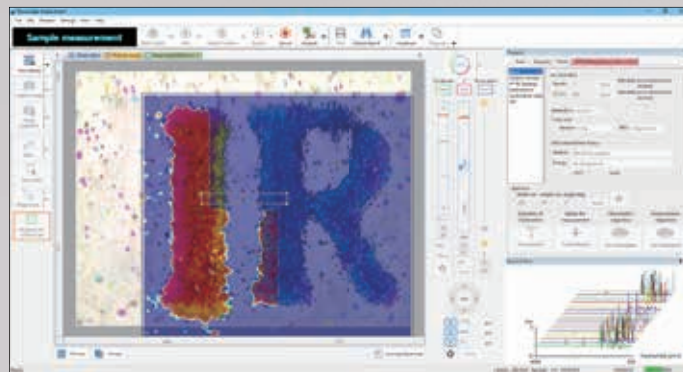
Fast IR Imaging

High-Speed Measurement at 160 Hz

The IRT-7X's high-speed motorized stage and 16-channel linear array detector, combined with FTIR rapid-scan measurements, enable high-speed data acquisition up to 160 Hz.

Advanced Digital Processing for Real-Time Monitoring

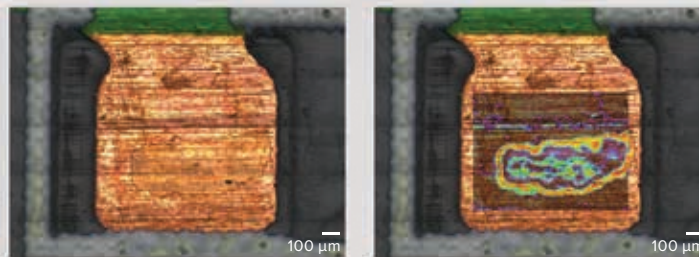
Signals from the 16-channel linear array MCT detector are processed simultaneously at each channel using a specially designed parallel circuit. The newly developed, channel-independent auto-gain function optimizes the signal of each channel. This enables faster data acquisition and produces clearer, higher-definition measurement data. Additionally, measurement data is processed in real time using parallel computation, achieving rendering speeds up to 4 times faster than conventional systems and significantly enhancing real-time image rendering.



<Applications>

Foreign Material Analysis

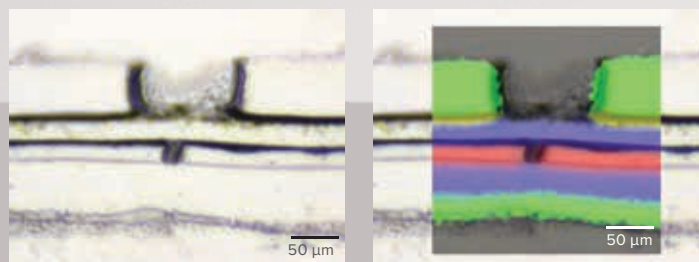
By dividing the target area into fine sections, the system acquires spectral data and visualizes component distributions using intuitive color coding. This approach enables the clear and precise identification of structural differences in foreign materials that are not detectable by visual inspection.



Foreign material analysis on printed circuit board (microscopic reflection method)
left: observation image
right: overlay of observation image and chemical image

Visualization of Component Distribution

In material development and evaluation, the ability to visually overlay infrared spectral information, including chemical structure and component distribution, onto sample images allows for more efficient optimization and verification of material properties.



Cross-sectional analysis of food packaging film (microscopic transmission method)
left: observation image
right: overlay of observation image and chemical image
green: polypropylene
yellow: ethylene vinyl acetate (+ colored material)
purple: polyethylene
red: polyethylene terephthalate

High-Quality Observation

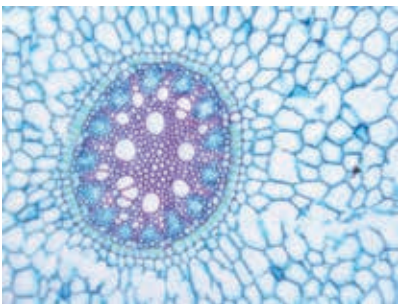
Clear, high-quality observation images help to quickly identify the right measurement points.

JASCO X16

Optimized Observation Optics

Equipped with a 5MP high-resolution camera and newly designed optics, the system produces vivid, high-contrast observation images. Clear observation images can be achieved even under low-light conditions, such as when analyzing low-reflectivity samples or using visible polarizers.

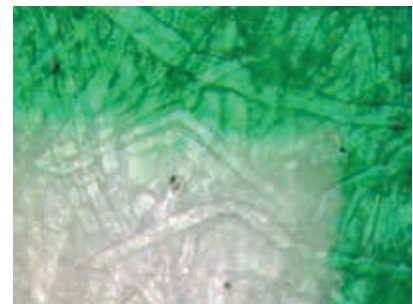
Observation image (x16 cassegrain mirror)



Iris root (transmission)



Contamination on solder (reflection)

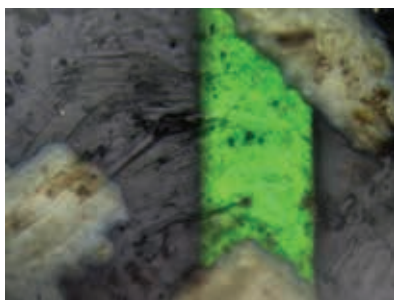


Printing on a business card (reflection)

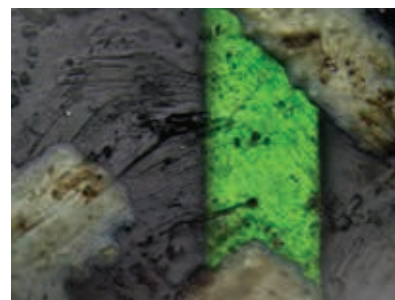
Electric Iris Mechanism

An electronically controlled iris mechanism operates in synchronization with both observation and measurement modes, providing sharper observation images while also enhancing spectral data quality.

Observation image of electronic board (x16 cassegrain mirror)



Without electric iris



With electric iris

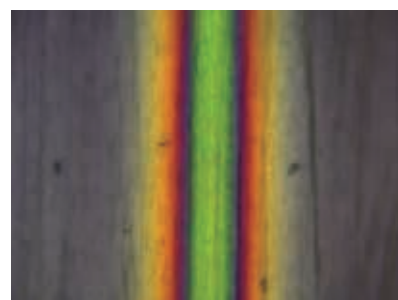
Polarization Observation Function

When equipped with the optional visible polarization observation function, the system enables visualization of sample birefringence, offering valuable insights into molecular orientation and crystallinity. This capability is particularly effective for observing materials with orientation-dependent properties, including plastics, polymers, and fibers.

Polarization observation of uniaxially stretched film



Conventional observation

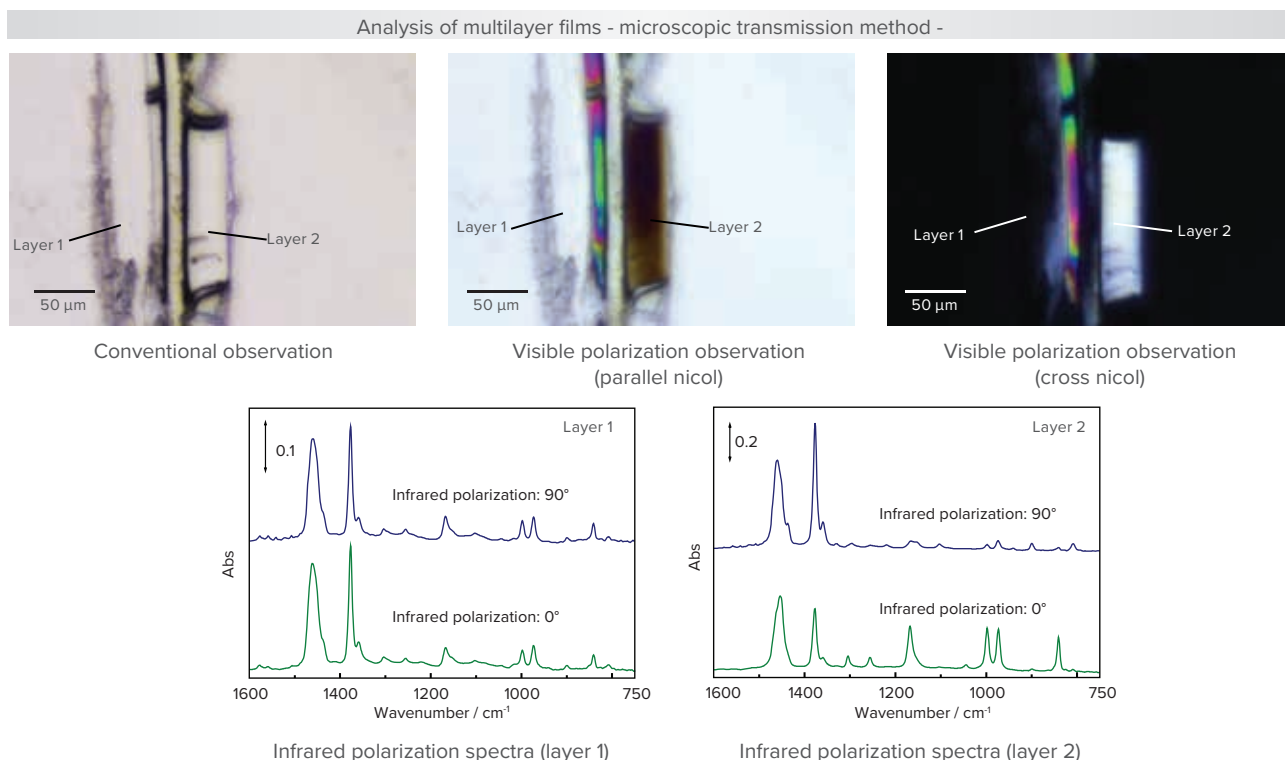


Polarization observation

<Applications>

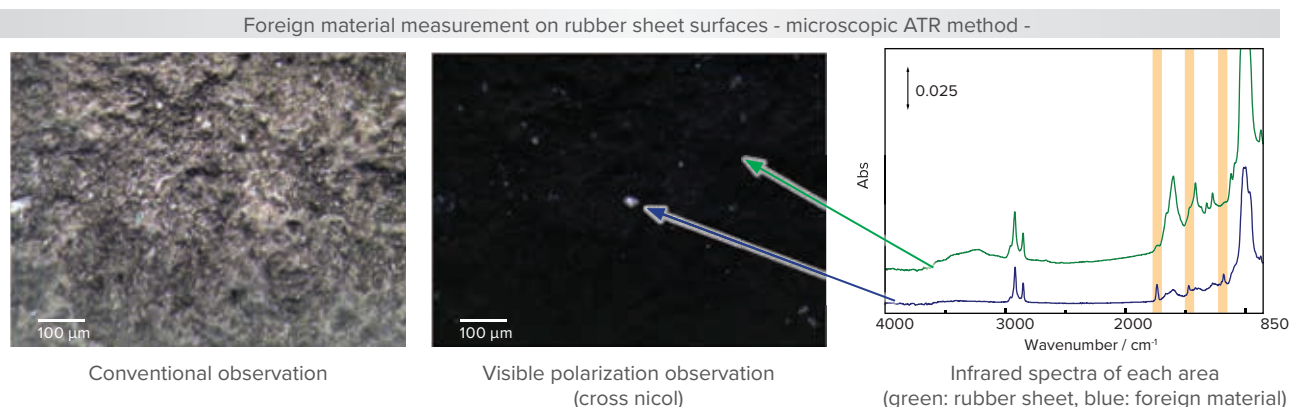
Combined Analysis of Visible Polarization Observation and Infrared Polarization Measurement - Evaluation of Multilayer Film Structures -

The combined use of visible polarization observation and infrared polarization measurement enables a more comprehensive and multifaceted evaluation of molecular structure. In this application, the layered structure of a food packaging film (featuring polypropylene layers on the inner and outer surfaces) was analyzed using an infrared microscope. Visible polarization observation images revealed differences in the molecular orientation between polypropylene layer 1 and layer 2 that are not detectable using conventional observation methods. Specifically, layer 1 exhibited no discernible molecular orientation, whereas layer 2 showed clear evidence of molecular orientation. These observations were further supported by quantitative infrared polarization measurements. For layer 1, changes in the polarization direction resulted in little to no variation in peak intensity. In contrast, layer 2 displayed pronounced changes in peak intensity when the infrared polarization direction was changed, confirming strong orientation of the polypropylene main chains in the vertical (0°) direction of the image. In summary, visible polarization observation provides qualitative visualization of molecular orientation differences, while infrared polarization measurement enables detailed quantitative evaluation of molecular orientation.



Combined Analysis of Visible Polarization Observation and Infrared Measurement - Small Foreign Material with Birefringence -

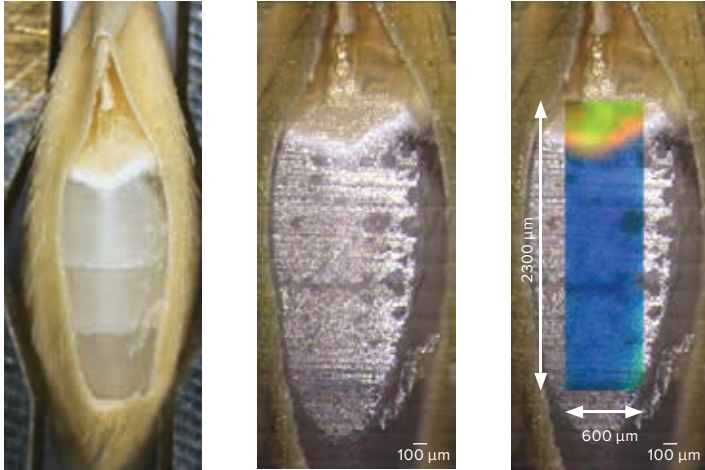
Visible polarization observation enables the clear detection of even small birefringent foreign materials. When searching for these particles, conventional optical observation may fail to identify foreign materials due to fine surface irregularities or complex sample patterns. In contrast, visible polarization observation proves highly effective, even under these challenging conditions. As an example, foreign material in a rubber sheet was visualized using visible polarization observation and subsequently analyzed with a reflection optical system. This approach allowed small foreign materials (appearing as white regions in the visible polarization observation) to be clearly identified that were not detectable using conventional observation methods. Furthermore, infrared analysis revealed a characteristic absorption band (highlighted in orange in the infrared spectra) exclusively within these white areas, suggesting the presence of ester-based additives deposited on the surface.



Multiple images

The use of multiple images enables the acquisition of clear, wide-field images.

Infrared imaging measurement of rice with husks - microscopic reflection method -



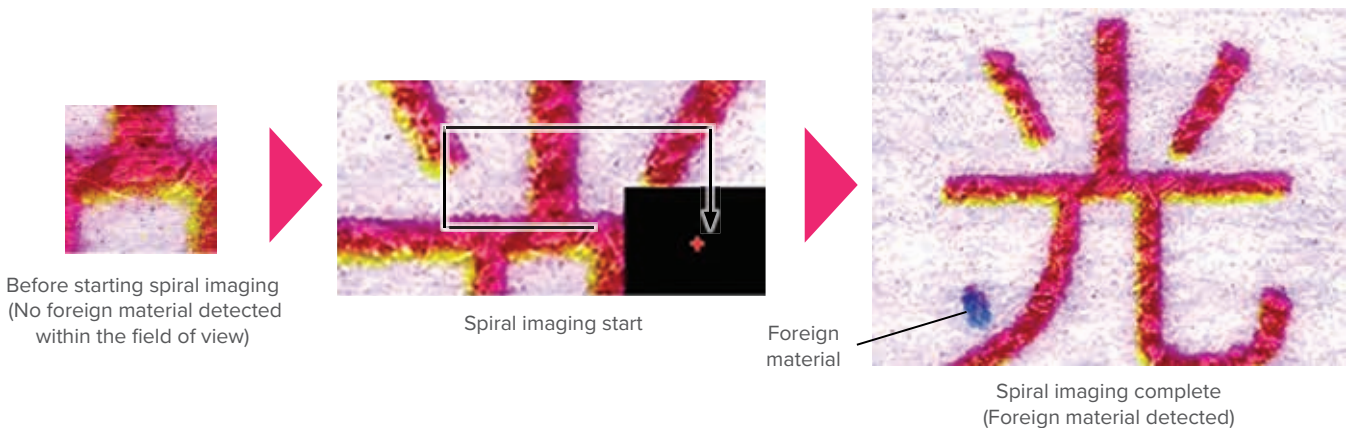
left: observation image (stereomicroscope)
center: observation image (4x objective lens)
right: overlay of observation image and chemical image (green: protein, orange: lipid, blue: starch)

We would like to express our sincere gratitude to JASCO Engineering Co., Ltd., Japan, for providing the data.

Spiral Imaging

Images can be acquired in a spiral pattern from the current field of view position, enabling the system to effectively scan the entire sample for quick exploration of the measurement targets.

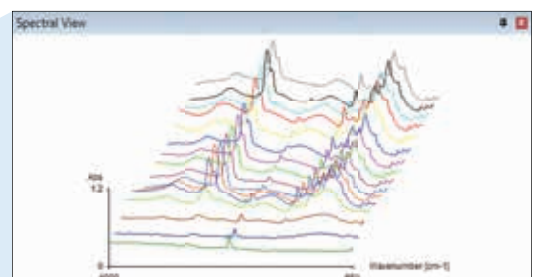
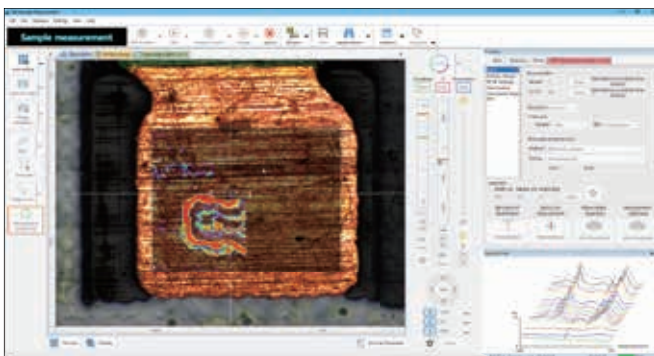
Examples of spiral imaging



Simultaneous Monitoring of Measurement and Observation

The direct-through method enables visualization of regions that are otherwise obscured by the aperture, allowing the entire sample area beyond the measurement region to be observed. In addition, IQ Monitor allows users to simultaneously view microscopic images and spectral data during measurement point selection, ensuring more precise and informed analysis.

IQ Monitor

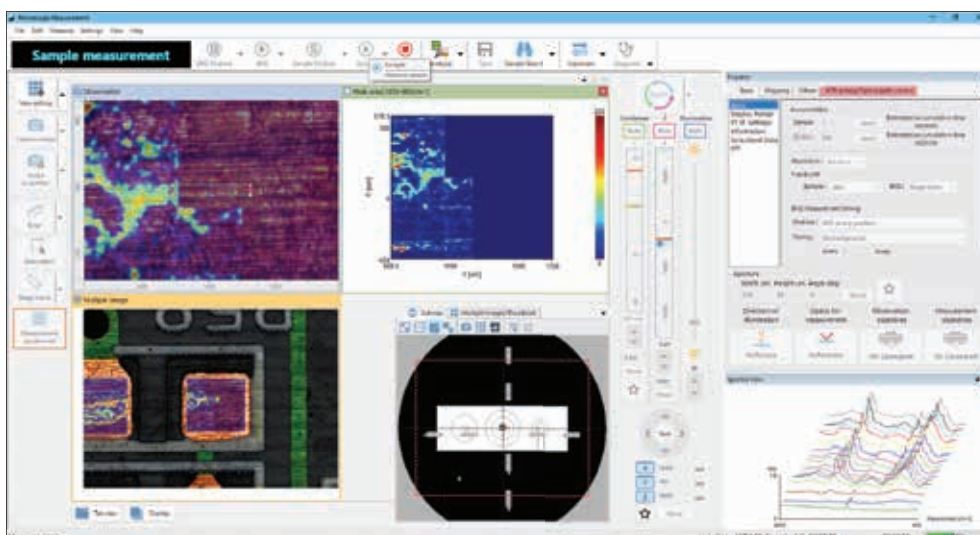


Automation & Usability

Supports imaging data acquisition with intuitive and simple operation.

Operation Improvement by Newly Designed User-Interface of Micro Measurement Program

By carefully simulating user workflows, a new user interface was created that organizes the screen layout into "Observation Image / Stage Control / Measurement Tools / Measurement Condition Settings + Spectrum". This intuitive, workflow-oriented layout improves operational efficiency by allowing measurements to be obtained faster and more efficient. Each sub-window can be customized and toggled on or off, allowing users to view essential information at a glance. In addition to the main observation image, a merged image can be displayed side by side, enabling measurement regions to be defined on either image. During measurements, chemical images can be displayed in real time on both the main observation and merged images. The submap view provides a comprehensive overview of the autostage, allowing immediate stage movement by clicking any position on the submap. This functionality enables rapid access to measurement points immediately after sample placement.



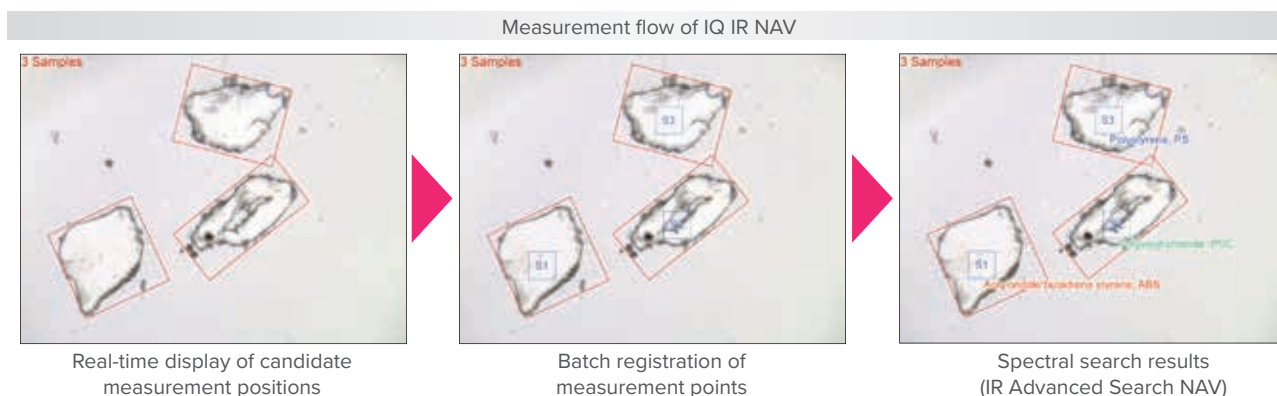
Micro measurement program

Measurement Support Functions

The IRT-7X includes the following two navigation functions to assist with sample measurement:

IQ IR NAV detects measurement targets on the observation image in real time, utilizing advanced image processing and automatically registers and measures their coordinates.

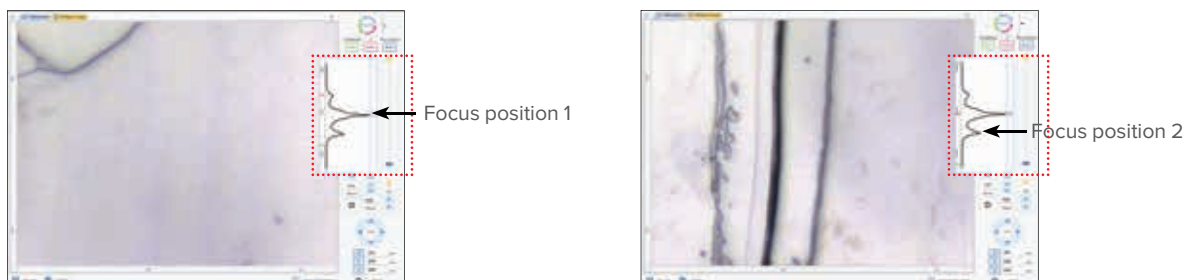
IR Advanced Search NAV filters measurement targets based on sample characteristics, such as size and circularity, displaying the spectral search results in real time on the observation image.



Autofocus

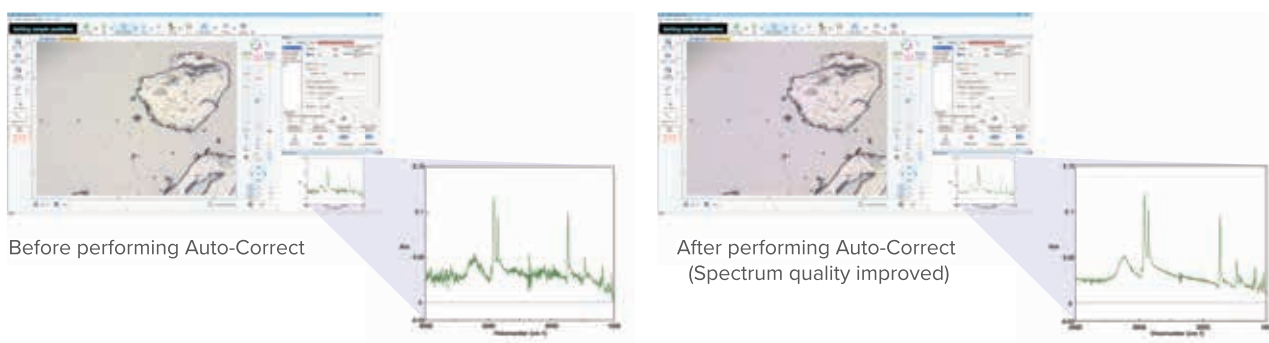
Samples pressed onto substrates, such as KBr or diamond, have several focal positions (e.g., the top surface, sample surface, and bottom surface), which can make precise focusing on the sample surface challenging. The autofocus function provides a numerical focus profile displayed as a graph, allowing users to easily identify the optimal focal position. Clicking on a peak in the graph automatically moves the stage to the corresponding Z-position. In addition, the system allows registration of frequently used focus positions, which streamlines focus adjustments for different samples and significantly improves workflow efficiency.

Observation image using x16 cassegrain mirror - KBr plate of multilayer film for food packaging -



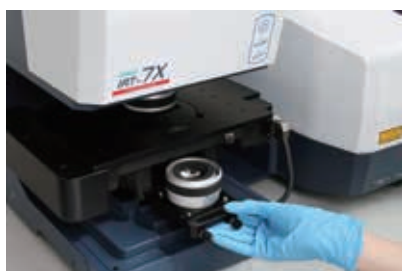
Auto-Correct - Automatic Condenser Mirror Adjustment -

To obtain a clear transmission spectrum, the upper and lower Cassegrain mirrors must be accurately aligned to maximize measurement light throughput. In practical applications; however, the infrared focal position can shift due to refraction caused by the thickness of the sample or its holding substrate. The Auto-Correct function automatically adjusts the condenser (lower Cassegrain) mirror to the optimal focal position, enabling ideal measurement conditions to be reliably achieved with confidence.



Condenser Mirror Slide-In Mechanism

A convenient slide-in mechanism enables the quick and effortless exchange of the condenser mirror to change magnification. The IRT-7X supports reflection measurements for samples up to 40 mm thick.



Hardware Replacement Navigation

An intuitive and animated navigation guides users through a variety of hardware replacements to ensure an easy, safe, and confident workflow.

Hardware replacement navigation

- Changing the Z stage height
- Removing and attaching the spacer
- Replacement of the Condenser Mirror
- Replacement of ATR/RAS accessory
- Replacement of Objective lens



Example navigation for "replacement of the condenser mirror"

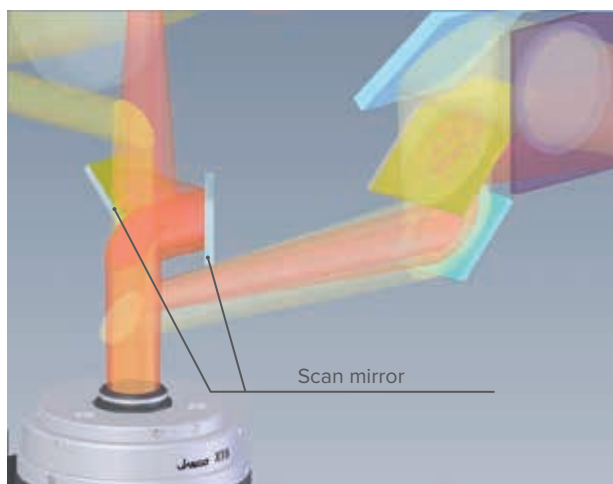
Unique Innovative Technology

The IRT-7X delivers highly reliable ATR imaging using unique JASCO innovative technology.



Innovative IQ Mapping technology (JASCO patent)

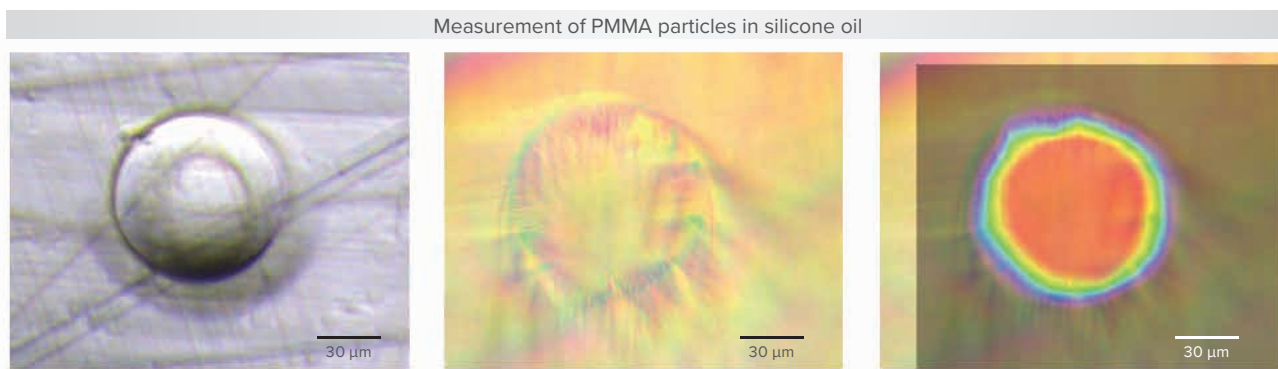
The IQ Mapping function operates using a mechanism similar to two-dimensional laser scanning with a galvanometer mirror, as employed in laser microscopy. It enables rapid and accurate two-dimensional scanning of the sample surface using infrared light. This approach allows ATR imaging to be performed while the sample remains in close contact with the ATR crystal, ensuring accurate measurements while minimizing the risk of cross-contamination. Even when slight sample movement or deformation occurs upon contact with the ATR crystal, the ClearView ATR (ATR-5X-SD) allows direct observation of the sample in its contacted state. By overlaying the ATR chemical imaging data with the actual physical appearance of the sample, the system provides more accurate, reliable, and insightful analytical results without moving the stage.



Overview of IQ Mapping

Example of ATR imaging measurement using the ClearView ATR and IQ Mapping

During the analysis of liquids, foreign material may shift upon contact with the ATR crystal. By combining the ATR-5X-SD with IQ Mapping, foreign material in liquids can be measured with high reliability.



Observation image (before ATR contact)

Observation image (after ATR contact)

Overlay of observation image and chemical image (peak height at 1,718 cm^{-1})

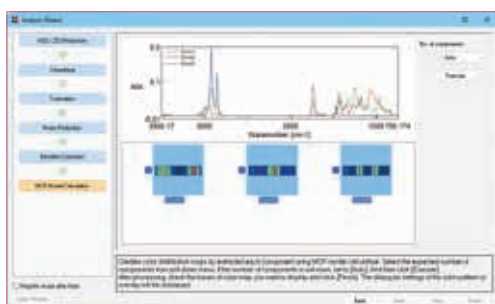
Various Analyses

Advanced programs analyze measurement data from multiple angles, unlocking new insights.

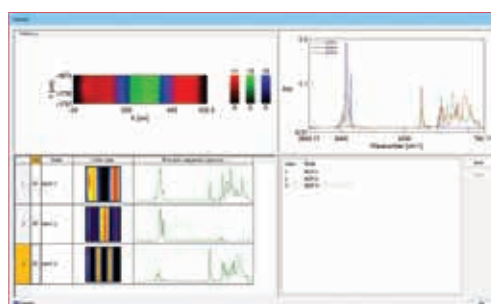
Imaging measurement of multi-layer film

Analysis Wizard

The analysis wizard guides the user through a simple flowchart to optimize parameters for data processing to effortlessly generate color-coded maps based on principal component analysis.



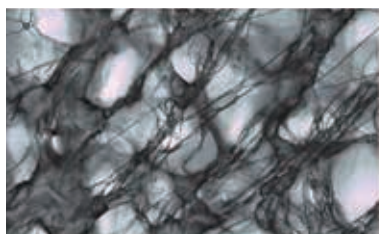
Executing MCR calculation



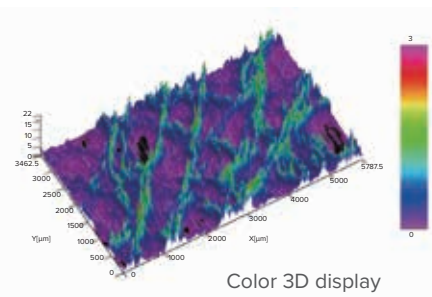
Creating color-coded maps

Chemical Image

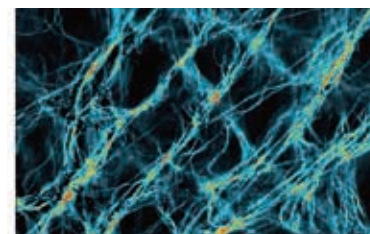
Chemical images can be visualized using a variety of display formats, including color 3D color display, color-coded mapping, and contour plots. In addition, chemical images can be seamlessly overlaid with their corresponding optical observation images.



Observation image



Color 3D display

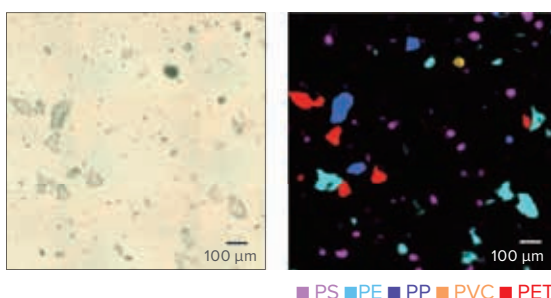


Overlay of observation image and color-coded map

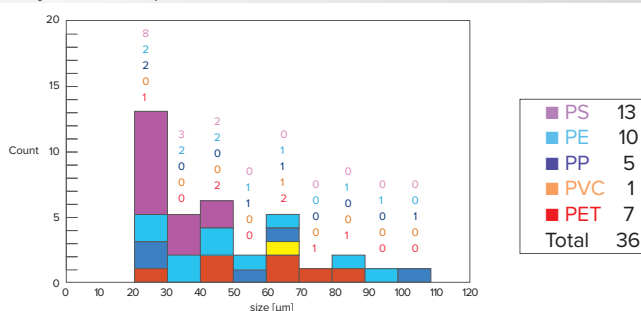
JASCO Particle Analysis

The JASCO Particle Analysis program quantifies parameters, such as particle size, area, circularity, aspect ratio, and more, for each particle using combined observation and chemical image data, enabling the generation of histograms, frequency distribution tables, correlation graphs, and component ratios.

Particle size analysis of microplastics



■ PS ■ PE ■ PP ■ PVC ■ PET



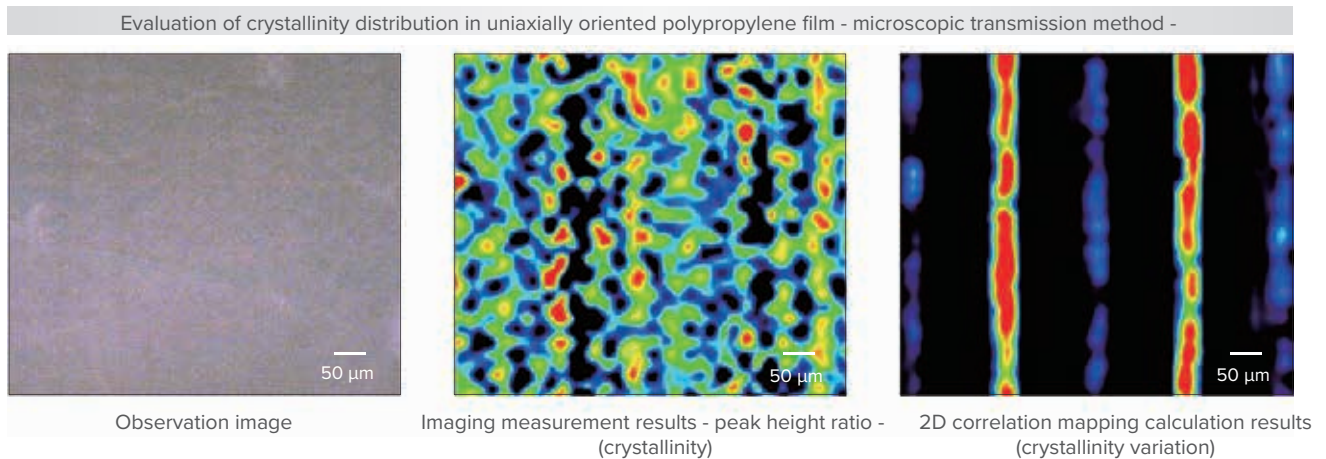
Observation image (left) and imaging measurement results (right)

Cumulative histogram by component (horizontal axis: particle size)

We would like to express our sincere gratitude to TOSOH Analysis and Research Center Co., Ltd., Japan, for providing the data.

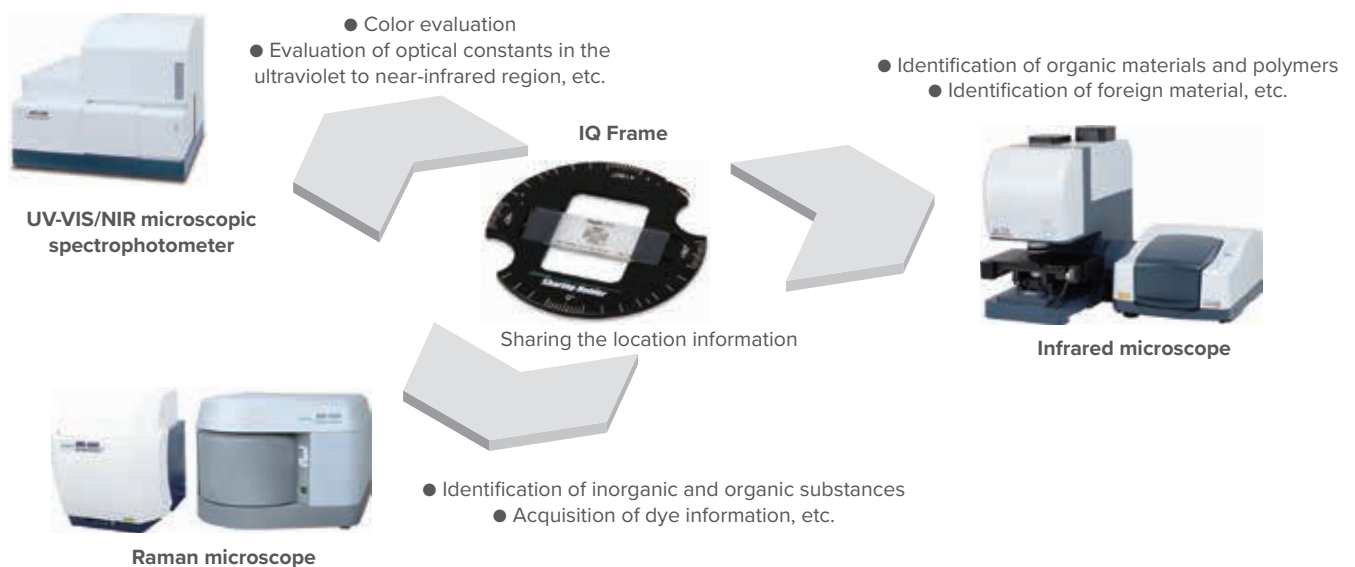
Disrelation 2D Correlation Mapping (Optional)

Developed by Dr. Hideyuki Shinzawa of the National Institute of Advanced Industrial Science and Technology (AIST), 2D Correlation Mapping is an analytical method that enables clear identification of phase boundaries associated with spectral changes. 2D Correlation Mapping allows areas exhibiting significant changes in crystallinity, molecular orientation, or hydrogen bonding to be readily visualized and distinguished.



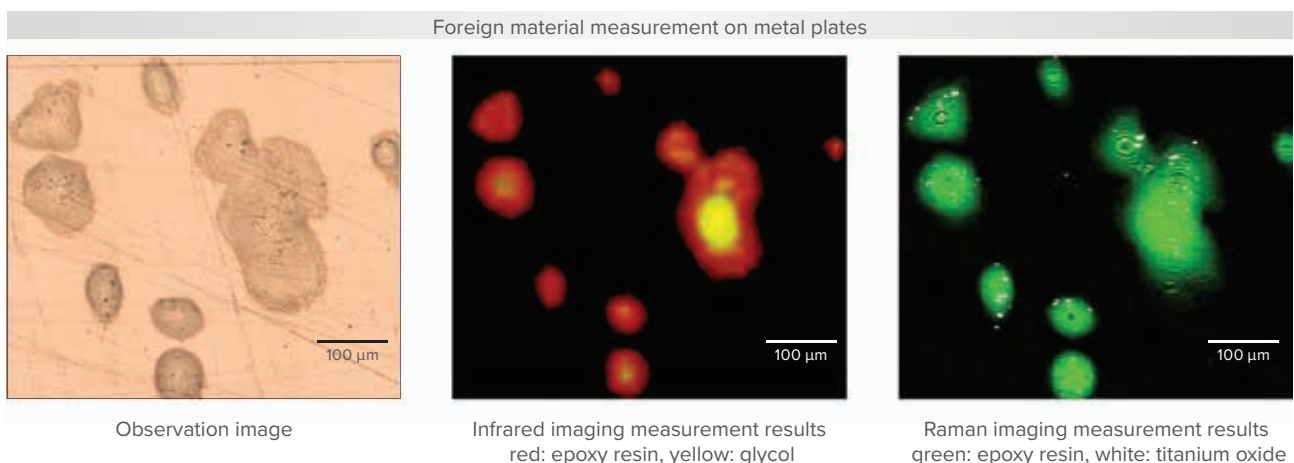
Enhancement of Analysis Accuracy with IQ Frame (Optional)

The combination of the autostage and IQ Frame allows to measure in the same location on a sample seamlessly by infrared microscope, Raman microscope, and UV-VIS/NIR microscopic spectrophotometers. Since infrared spectroscopy and Raman spectroscopy are particularly complementary, obtaining both spectra enhances the accuracy of analysis.



Combined Analysis Using Infrared and Raman Microscopes

The combination of infrared and Raman spectroscopy provides a richer and more comprehensive molecular characterization from a single sample, resulting in highly reliable analytical results. IQ Frame ensures perfect alignment between infrared and Raman measurements, eliminating positional differences and enabling fast, accurate acquisition of complementary data.





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