FTIR Microscopy

IRT-5000 Series FTIR Imaging Microscopes

JASCO

Performance
Innovation
Reliability

SEE THINGS YOU NEVER SAW BEFORE.

IQ Mapping lets you visualize your sample without moving or disturbing the stage or the sample itself. Spectra Manager™ Imaging Analysis identifies and maps the spatial distribution of multiple functional groups in the sample's matrix to create a detailed high-resolution image.

JASCO designs and manufactures a comprehensive range of FTIR products at its research headquarters in Tokyo, Japan. With a commitment to advanced optical instrument design spanning more than five decades, culminating in the latest IRT-5000 and 7000 series of FTIR imaging microscopes. JASCO is proud to offer unrivaled, class-leading performance in FTIR spectroscopy, using the best in materials and electronics technology available today.

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Features of the IRT-5000 Series

The IRT-5000 Series of FTIR microscopes is a comprehensive, versatile system for measurement with high spectral and spatial resolution. The IRT-5000 Series is extremely useful for materials characterization and imaging analysis to identify components and their distribution in complex matrices.

The IRT-5000 microscope is used for both sample observation and measurement with unique options for improving the visualization of samples, and a multi-objective revolver for use with many different types of cassegrains, ATRs or refractive objectives. The standard microscope is optimized for high sensitivity measurement in the mid IR using an MCT detector or a DLaTGS detector, with a range of optional components to extend the range from the visible to the far-IR.

Features that are unique to the JASCO microscope include: IQ Mapping, IQ Frame and IQ Monitor, with Spectra Manager™ Microscope Imaging Suite, enhance the analysis and imaging results.

FT/IR-6700 with IRT-5200

Key Features

- IQ mapping for mapping measurement using a manual (or auto) stage
- Up to two detectors with an option for user exchangeable detectors for the widest possible spectral range
- IQ Monitor for simultaneous visible image observation and IR spectrum measurement
- High resolution CMOS camera, with 3x optical zoom
- Integrated control panel for simple operation
- Optional joystick for stage control
- Option for vacuum optical system and sample chamber
- Automatic stages for temperature control

FT/IR-4700 with IRT-5200

Powerful FTIR Microscopy for Challenging Samples

The IRT-5000 Series microscopes can be paired with either an FT/IR-4000 or FT/IR-6000 spectrometer to make systems for materials measurement, mapping and imaging. The IRT-5000 Series microscopes are permanently aligned with an external optical port at the side of the interferometer for switching between macro- and micro- measurement modes without the need for optical re-alignment. All models can be used for transmission, reflection and ATR sample measurement, with a choice of manual or auto-stages.

When combined with JASCO's unique and innovative IQ Mapping™ technology, the IRT series microscopes are the ideal tools for the measurement of challenging samples.

With IQ Mapping™ and Clear-View ATR objectives **there are no measurement area limitations, and without the damage to samples that normally affects measurement when the ATR objective is moved.** Large sample areas can be measured using ATR, transmission and reflection with imaging analysis without moving the sample or auto- stage.

IRT-5000 Series Infrared Microscopes

IRT-5100

The IRT-5100 is a general purpose FTIR microscope employing a standard DLaTGS detector without the requirement for liquid N_2 cooling. The IRT-5100 can also be fitted with a second detector. An optional automatic XYZ stage provides auto-focus and mapping measurement.

- Dual detector capability
- Variety of measurement modes (transmission, reflection, ATR, Grazing Angle Reflection)
- Multiple objectives capability (up to 4)
- Optional automatic XYZ sample stage, with joystick control
- Spectrum preview to confirm conditions before measurement
- Data storage linked with sample image and measurement information
- High speed data processing for fast results

IRT-5200

With an expandable spectral range and high-clarity visual observation, the IRT-5200 includes:

- IQ Mapping for sample imaging without moving the stage
- XYZ auto-stage with joystick control (optional)
- Dual detector capability and optional user-swappable detectors
- Multiple objectives capability (up to 4) with automatic revolver
- Spectrum preview to confirm conditions before measurement
- Data storage linked with sample image and measurement information
- High speed data processing for fast results

IQ Mapping™

Automatic XYZ Stage

Automatic XYZ Stage

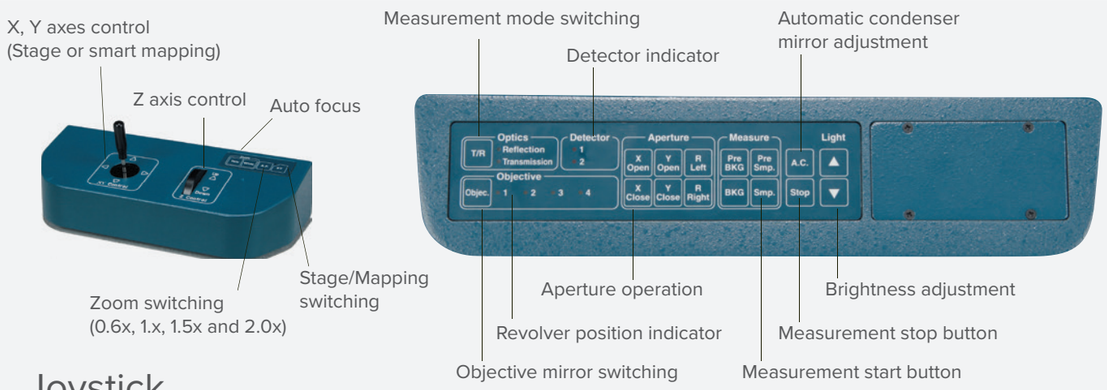
IPS-5000

The imaging software included with the IRT-5200, precisely controls the automatic XYZ stage, this provides additional functions that are not available with the manual stage, such as wide-area mapping measurement, synthesis of the microscopic image, auto-focus etc.

Specification	
Movable Distance	X: 100 mm, Y: 75 mm, Z: 25 mm (1 µm step)
Sampling Weight	5 kg (Dead weight), 500 g (Usual weight)
With Auto Focus Function	

Powerful Mapping and Imaging with the XYZ Auto-Stage

The XYZ auto-stage takes full advantage of the mapping and imaging applications of the IRT-5000 Series. The auto-stage can be used for mapping measurements across a wider area than IQ Mapping (they can be used together for more versatile high speed mapping). In Spectra Measurement the auto-focus function provides a graphical indicator based on energy for the optimal focal position for sample measurement. For the analysis of multi-layer samples, this allows the focal position to be adjusted and set to each layer using the peaks displayed in the focusing graph. For simple and accurate movement, the auto-stage can be moved using the mouse pointer over the sample image in the measurement software, or by using a joy stick (option). The high precision position repeatability of the stage is +/- 1 µm. The auto-stage includes a shutter to protect the lower cassegrain from samples falling onto it.



Joystick

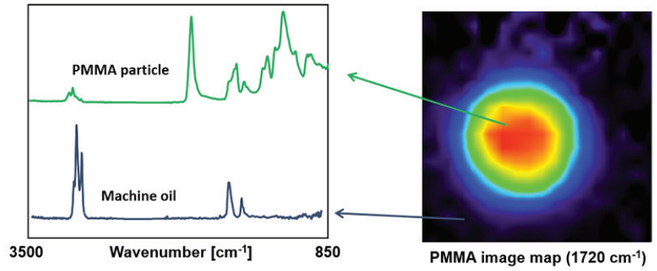
JOY-IPS-5000

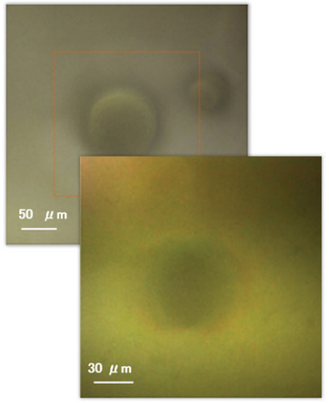
The auto-stage is controlled using the Spectra Manager imaging software (standard), and can also be controlled with the optional joystick. IQ Mapping, auto-focus and zoom can all be controlled using the optional joystick.

IQ Mapping™ can be used to measure difficult samples. Sample applications are outlined below (additional applications available upon request).

Measurement of Floating Samples: Example PMMA in Machine Oil

A small fragment of PMMA floating in machine oil was measured with a ClearView™ ATR objective using IQ Mapping™. A matrix of spectra was acquired, and the peak absorption at 1720 cm^{-1} was used to create a functional group image map of the particle.

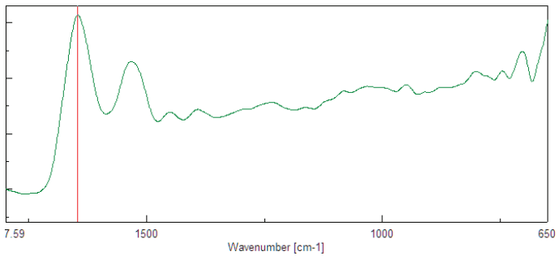




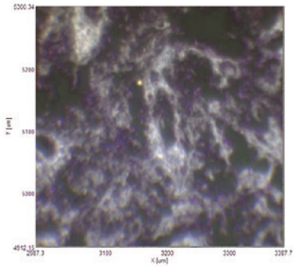
Reflection Measurement: Example Cancerous Human Tissue

A 375 x 375 µm area of a malignant tissue sample was measured and imaged using IQ Mapping™, in reflection mode, from an H&E stained Kevley™ slide using the linear array MCT imaging detector. The intensity plot shows the spatial distribution of the 1,647 cm^{-1} protein amide band at varying intensities throughout the sample. Using this imaging data array, the protein secondary structure can be calculated automatically in Spectra Manager™.*

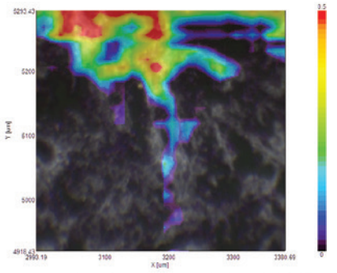
**IRT-7200 upgrade*



Malignant tissue spectrum magnified to the protein amide region



IQ Mapping™ - Imaging collection, reflection mode, of a malignant human tissue



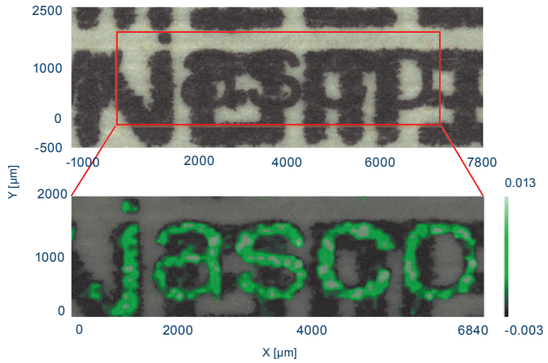
Intensity plot of protein amide band, 1,647 cm^{-1}, overlaid with visual image of cancerous tissue

IQ Family

IQ Mapping with Multi ATR Imaging

When an ATR objective is used together with IQ Mapping™, the area that can be measured with the ATR-5000-SD (diamond prism) is 180 x 180 µm without moving the stage. By combining an ATR objective with the auto-stage, imaging measurement can be made over a much wider area. The data shown (right), is the result from a printed object which is unreadable because of the overlay of a security stamp. The sample was imaged using the multi ATR imaging function which measured the spectral differences between the printed ink spectrum and that of the stamp ink.

Measurement Condition	
Detector	M-MCT
Objective Mirror	ATR-5000-SD
Measurement Area:	6.84 mm x 2.07 mm
Aperture Size:	90 µm x 90 µm
Measurement Point:	76 x 23 points (1748 points)



ATR imaging
(Overlay of microscopic view)

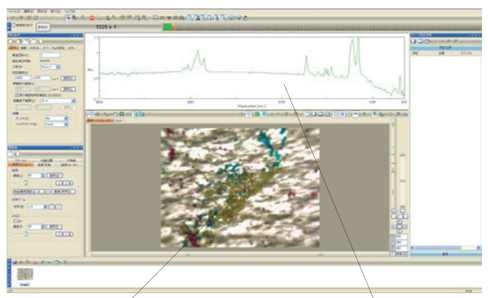
IQ Monitor - Monitoring Functions

Using a high resolution CMOS camera (3M pixel), a high quality microscopic image is displayed on the PC monitor and recorded in the data file. Digital zoom can be used to observe details at higher magnification, however the IRT-5000 Series also includes a 3x optical zoom (0.6 - 2x), which allows closer observation with much higher clarity than can be achieved simply with digital zoom.

A super-luminous white LED is used for sample illumination; this provides a pin sharp image. The illumination brightness is controlled with an auto-brightness function, which automatically selects a suitable brightness for the image. The direct-through function provides a microscopic image of the area which is obscured by the aperture during measurement. IQ Monitor allows the user to simultaneously confirm the sample image and the spectrum for determining the exact measurement point.

As options, either a color LCD monitor for displaying the microscopic image or binocular eyepieces for direct-observation can be mounted onto the body of the IRT-5000 Series. For enhanced observation the IRT-5000 Series can be used with polarization, differential interference contrast (DIC) or fluorescence observation, which are useful tools for locating target positions in a sample that have weak contrast.

IQ Monitor



Measurement point
(Direct through)

The spectrum of
measurement point
(IQ Monitor)

IQ Frame

Raman spectrometers are known to provide complementary information to IR analysis. And because a Raman spectrometer has the advantage of measurement in the low wavenumber region, it provides helpful information for inorganic analysis and crystal structure analysis.

JASCO has developed the IQ Frame technology, which uses a combination of mechanical position and image analysis to determine identical measurement points even when a sample is moved from one instrument to another.

IQ Frame enables measurement and analysis of exactly the same position for the sample using both IR and Raman microscopes. This effective tool can support combined analysis resulting in complementary information.

NRS-4500
Raman Spectrometer

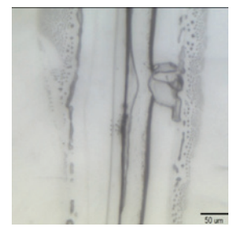
IQ Frame

Qualitative Analysis of Multi-Layer Film

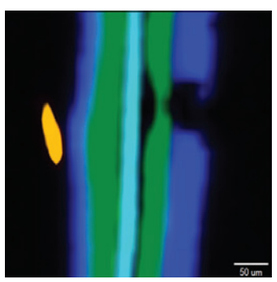
The figure below, right, shows the sample observation image of sliced multi-layer film. After mapping measurement, the principal spectra were calculated from the IR data and Raman data by MCR (Multivariate Curve Resolution). From the obtained principal spectra, the layers were identified using KnowItAll. Bottom figures show the chemical imaging which is created by using the scores of principal spectra.

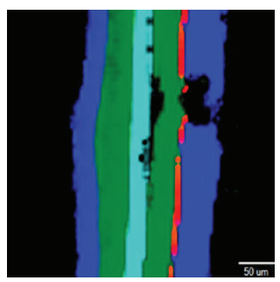
The analysis resulted in the visualization of the distribution of polypropylene, polyethylene and PET. Key points to note, cellulose which has large IR activity was obtained from the IR data. The component Titanium Oxide (TiO2) was obtained from Raman data, and was shown to be a thin layer (several µm).

Since cellulose is not typically a component of this film, this result indicates that the cellulose might be mixed with the film as contamination.



Observation View





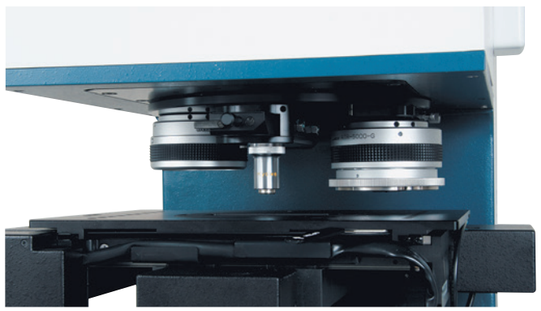
Chemical Imaging
(Left: from IR data, Right: from Raman data)

Green: Polyethylene
Aqua: PET
Blue: Polypropylene
Yellow: Cellulose
Red: TiO2

Cassegrains & Refractive Objectives

Automatic 4-Position Motor-Driven Objective Revolver

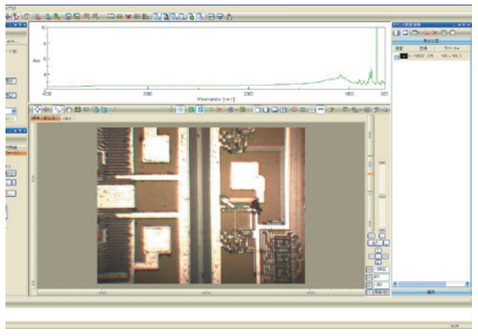
The IRT-5000 Series has an automatic 4-position motor-driven objective revolver with highly accurate positioning repeatability. The revolver has automatic objective recognition, with status display of the selected objective in the system monitor. The ATR and grazing-angle objectives are slide-in mounted for easy installation or removal, and the recognition sensor confirms the objective type used in the measurement program (ATR, RAS etc.).



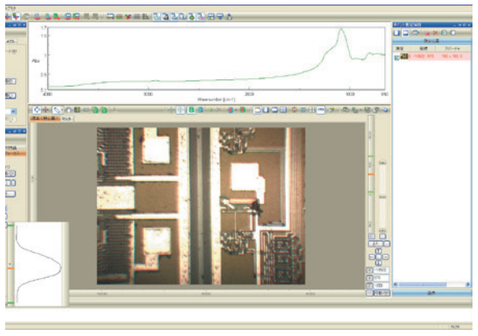
4-Position Motor-Driven Revolver

Automatic Optimization of the Condenser Cassegrain

When making transmission measurements,even though the observed image may be in focus, it is possible that the infrared light can be out of focus due to the thickness and/or refractive index of the sample, this can result in poor quality spectra. The IRT-5000 Series includes automatic adjustment of the position of the lower cassegrain the Z axis height is adjusted using the infrared energy, and the result is displayed graphically (the vertical axis displays the position of the condenser cassegrain, and the horizontal axis the energy intensity). The user can quickly confirm the correct focus from this visual information.



Before Optimization



After Optimization
(spectrum has been improved)

Cassegrains and Refractive Objective Lenses

For transmission and reflection measurement cassegrain objectives that can be selected with three levels of magnification - 10x, 16x and 32x, either as a cassegrain set (objective and condensing) for transmission or as a single cassegrain objective for reflectance measurement. The standard coating is aluminum (gold-coating is an option). In addition, refractive objectives with magnification of 4x, 10x and 20x are available for observation only.

Measurement Mode Switching

Model	Cassegrain Objective Description
RFO-30-16-57AL	16x pair (Al coating), standard for IRT-5000-16, IRT-7000-16
RFO-30-16-57	16x pair (Au coating),
RFO-30-32-70AL	32x pair (Al coating), standard for IRT-5000-32, IRT-7000-32
RFO-30-32-70	32x pair (Au coating),
RFO-30-10-45AL	10x pair (Al coating), standard for IRT-5000-10, IRT-7000-10
RFO-30-10-45AU	10x pair (Au coating),
RFO-30-16R-AL	16x single (Al coating)
RFO-30-16R	16x single (Au coating)
RFO-30-32R-70AL	32x single (Al coating)
RFO-30-32R	32x single (Au coating)
RFO-30-10R-AL	10x single (Al coating)
RFO-30-10R-AU	10x single (Au coating)

Model	Refractive Objective Description
OBJ-5000-4	x4 objective lens
OBJ-5000-10	10x objective lens
OBJ-5000-20	x20 objective lens

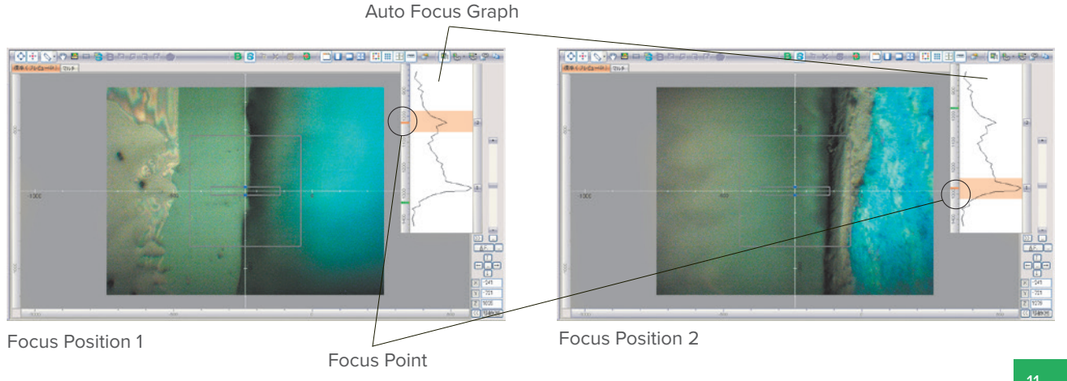
**When performing near IR measurement, gold-coated optics are required.*

Specifications

	Normal Sample Viewing Area	Aperture Setting Area	IQ Mapping Measurement Area
16x Cassegrain	600 µm x 480 µm	X: 0-500 µm, Y: 0-500 µm (Max. 500 x 500 µm)	X: -200-200 µm, Y: -200-200 µm (Max. 400 x 400 µm)
32x Cassegrain	300 µm x 240 µm	X: 0-250 µm, Y: 0-250 µm (Max. 250 x 250 µm)	X: -100-100 µm, Y: -100-100 µm (Max. 200 x 200 µm)
10x Cassegrain	960 µm x 768 µm	X: 0-800 µm, Y: 0-800 µm (Max. 800 x 800 µm)	X: -320-320 µm, Y: -320-320 µm (Max. 640 x 640 µm)

Auto Focus

When the IRT-5000 Series is used with an XYZ auto-stage the focus can be automatically adjusted using contrast information from the sample image. After performing the auto-focus, a graph is displayed (the vertical axis indicates the Z height of the stage, and the horizontal axis the contrast.). For samples that may be difficult to focus, such as KBr plates or a diamond anvil cell, the auto-focus function can easily perform this task.



Clear-View™ ATR Objectives

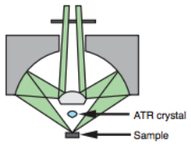
Sample Viewing for a Sample in Contact with the ATR Crystal

The Clear-View ATR objectives allows both viewing of the sample and ATR spectral measurement by simply moving the crystal position (up and down). The measurement area can be selected for the ATR-5000-SD and ATR-5000-SS ATR objectives whilst observing the sample after the prism is placed in contact, a function that is not available with conventional ATR objectives. This innovative function allows the selection of a specific area of the sample while observing the entire area of the sample in contact with the crystal element.

Specifications

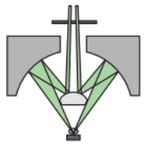
		ATR-5000-SD	ATR-5000-SS	ATR-5000-SG
Applicable Sample Refractive Index		1.0-1.5	1.0-1.5	1.0-2.7
Wavelength Range (cm^{-1})		7,000-2,500 1,600-700	7,000-700	5,200-650
Magnification	Crystal in Raised (View) Position	16		
	Crystal and Sample Contact (Sample Position)	35.2		64
ATR Crystal Element	Material	Diamond	ZnS	Ge
	Refractive Index (@ 1000 cm^{-1})	2.4	2.2	4.0
	Area in Contact with Sample	Φ 500 µm		Φ 250 µm
	Number of Internal Reflections	1		
Simultaneous Sample View when Crystal is in Contact with the Sample Surface		Possible		Impossible
IQ Mapping Area (µm)		180 x 180		100 x 100

Normal sample view with the crystal element in the raised position



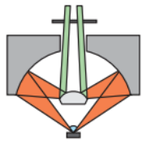
The ATR-5000-SD/SS/SG enables sample viewing by setting the ATR crystal in the raised position.

Sample viewing after crystal contact with the sample area



The ATR-5000-SD and SS enable sample viewing through the ATR crystal after contact with the sample surface.

ATR measurement and simultaneous sample viewing

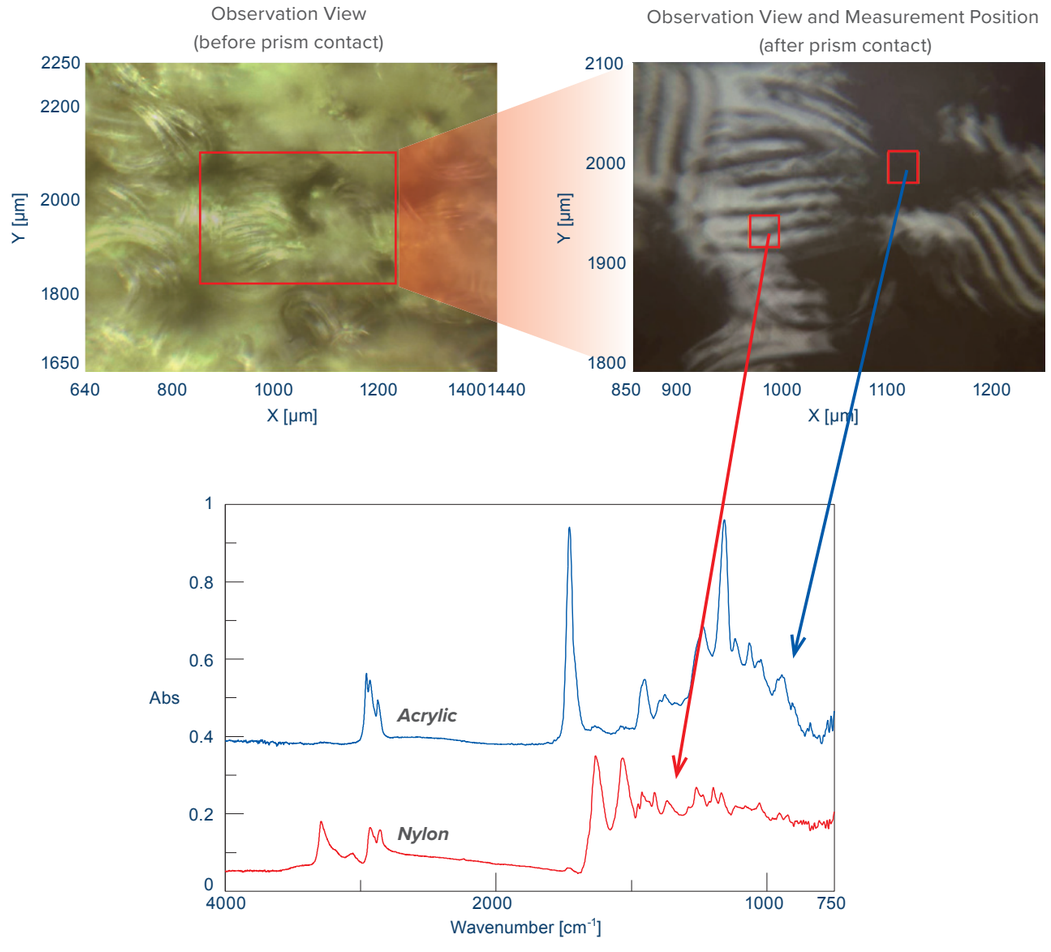


The ATR-5000-SD and SS provide simultaneous sample view during ATR data collection.

Clear-View ATR Objective for Clear Sample Observation

The Clear-View ATR objective provides clear and vivid observation of the sample through the prism. Both a mapping image and multiple measurements can be acquired without moving position for each measurement.

In the measurement shown below the Clear-View ATR objective, a mixed fiber was measured around the striated area in contact with the prism, the spectra taken from two different points shows that the sample is composed of a mixture of nylon (lighter area) and acrylic (darker area).



Measurement Results

ATR Objectives

The IRT-5000 Series has a wide range of sampling accessories for a diverse range of applications.

Attenuated Total Reflectance ATR

One of the key advantages of ATR measurement is minimal sample separation. ATR can be used for measurement of the surface layer and for contaminant identification. The IRT Series of microscopes has a wide range of ATR objectives.

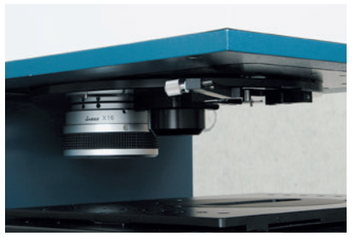
- Conventional type (ATR-5000-Z, G, D)
- Projection type (ATR-5000-G45, recommended for ATR measurement of samples with an uneven surface)

Item	Description
ATR-5000-Z	Prism: ZnSe, Incident angle: 50 - 60°
ATR-5000-G	Prism: Ge, Incident angle: 40 - 50°
ATR-5000-D	Prism: Diamond, Incident angle: 50 - 60°
ATR-5000-G45	Projection type, Prism: Ge, Incident angle: 35 - 45°

**When using a cassegrain ATR, a pressure sensor is required.*

Cassegrain ATR

Example of ATR Cassegrain mount (Slide-in type)

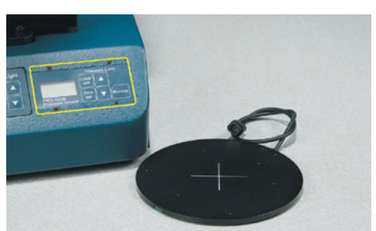


Pressure Sensors

PRS-M-5000/PRS-A-5000

A pressure sensor is used with the ATR cassegrain to apply exactly the right amount of contact pressure between the sample and prism, an audible alarm alerts the user when the preset pressure is reached. In addition, for ATR mapping, the sensor controls the contact to perform measurement under constant pressure. The pressure can be set and monitored in both the Spectra Manager measurement program and the control panel on the front of the IRT-5000.

**The PRS-M-5000 pressure sensor is used with the manual stage, and the PRS-A-5000 is used with the automatic XYZ stage.*

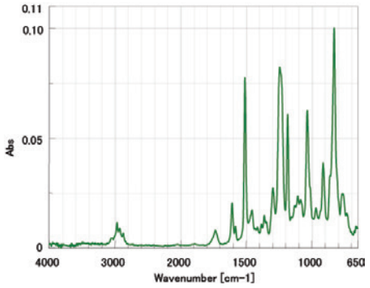


Pressure Monitor Sensor

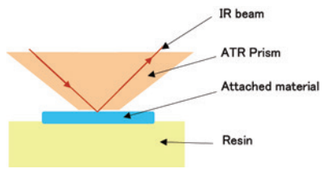
Measurement of a Material on a Resin Substrate

Both ZnSe and diamond prisms have low refractive index, and the resulting penetration depth is greater than that of germanium. This results in larger absorption peaks when using either of these prism materials.. The application described here shows the results using a micro ATR of a material attached to a resin substrate. From the measured spectrum, the contaminant was identified as epoxy resin.

Prism	Refractive index (Prism)	Penetration depth (1000 cm-1)	Measurable refractive index (Sample)	Measurement Wavenumber
ZnSe	2.4	Approx. 2.0 µm	Less than 1.7	Down to 650 cm^{-1}
Diamond	2.4	Approx. 2.0 µm	Less than 1.7	Down to 400 cm^{-1}
Ge	4	Approx. 0.6 µm	Less than 2.5	Down to 830 cm^{-1}

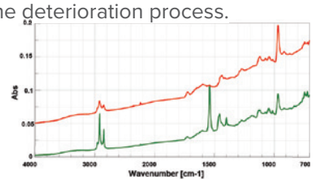


Spectrum of attached material
(When using ZnSe prism)

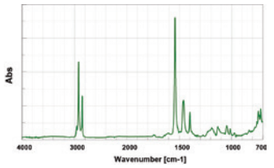


Measurement of Rubber with High Refractive Index

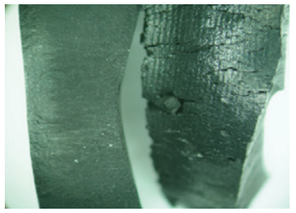
Germanium is an excellent prism material for ATR measurement of higher refractive samples (such as black rubber). This application shows the result for analysis of deteriorated rubber (blooming); a subtraction spectrum was calculated between normal rubber and deteriorated rubber. From the result of the subtraction spectrum, it can be clearly seen that zinc stearate is lost during the deterioration process.



Spectrum of rubbers
(Green: Normal rubber, Red: Deteriorated rubber)



Subtraction spectrum



Sample view
(Left: Normal rubber, Right: Deteriorated rubber)

Grazing Angle Reflection Objective

RAS-5000

Reflection absorption spectrometry (RAS) is used for the measurement of thin films on a metal surface using polarized light. Compared with conventional reflection measurement, sensitivity can be increased by up to a few orders of magnitude. The grazing angle reflection objective includes a recognition sensor, and has a slide-in mount.

Specifications	
Incident Angle	70°± 10°
Number of Reflection	1

**PL-IR-5000 is required separately.*

IR Polarization Measurement

PL-IR-5000

The PL-IR-5000 measurement polarizer is mounted in the IR microscope, and the measurement program can control automatic insertion/removal and the angle of rotation of the polarizer. This accessory is typically used for orientation measurement of mono-crystal and mono-filament samples. In addition, it can be combined with the RAS-5000 objective (left) for reflection absorption spectrometry.

Specifications	
Polarizer	Wire-grid type KRS-5
Angle Control	0 - 175° (1° step)

**When upgrading to the linear array detector, the PL-IR-5000 cannot be used*

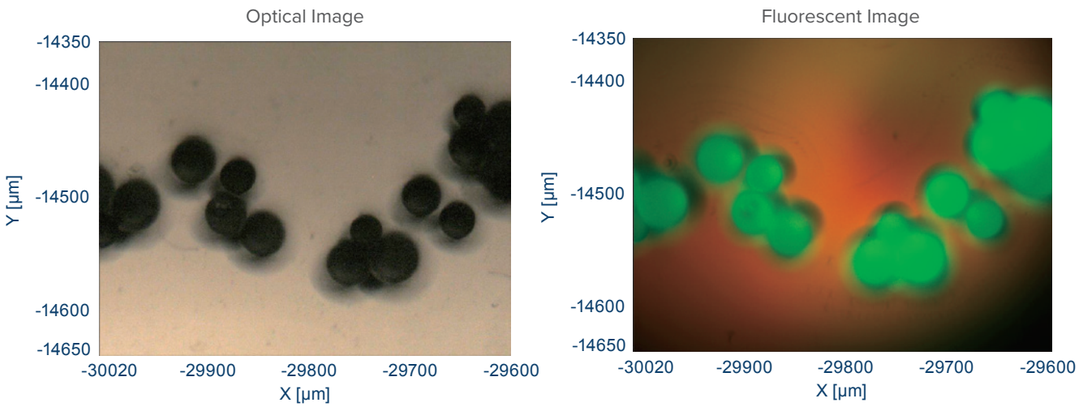
Sample Observation

Fluorescence Observation

MF-5000VIS / MF-5000UV

Fluorescence observation can be used to identify fluorescent samples which cannot be seen with visible light. Two options are available with different wavelength ranges. The wavelength range is selected with a filter.

Specifications	MF-5000VIS	MF-5000UV
Light Source	75 W Xe lamp	100 W Xe lamp
Available Wavelength	400 - 700 nm	250 - 700 nm
Ex. Wavelength	400, 480 nm (Band pass filter) Up to 5 filters can be mounted.	330, 400, 480 nm (Band pass filter) Up to 5 filters can be mounted.
Em. Wavelength	540, 600, 700 nm (Band pass filter) Up to 5 filters can be mounted.	450, 540, 600, 700 nm (Band pass filter) Up to 5 filters can be mounted.
Observation Camera	Cooled type CCD camera	Cooled type CCD camera for UV

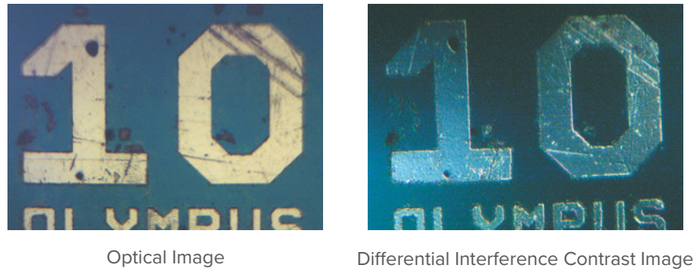


Differential Interference Contrast Observation

DIC-5000

For observing a clear sample or a sample with low contrast, the DIC-5000 can accentuate the contrast for improved sample observation. The DIC-5000 is typically used with a 10x refractive objective lens.

**10x*



Optical Image

Differential Interference Contrast Image

Visible Polarization Contrast Observation

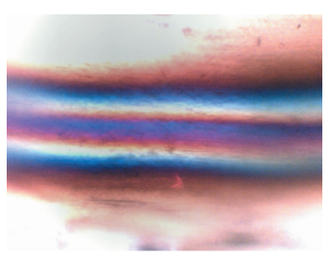
PL-E-5000 / PL-E-5000FV / PL-E-5000VIS

There are types of sample that are difficult to observe using visible light, these include monocrystals, minerals, and contaminants in polymer films etc. The use of polarized light dramatically improves the visualization of these samples.

**For polarization observation using the VIS-5000 binocular, both PL-E-5000 and PL-E-5000-VIS are required.*

**For polarization observation using the vacuum system, PL-E-5000FV (factory option) is required.*

Optical Image



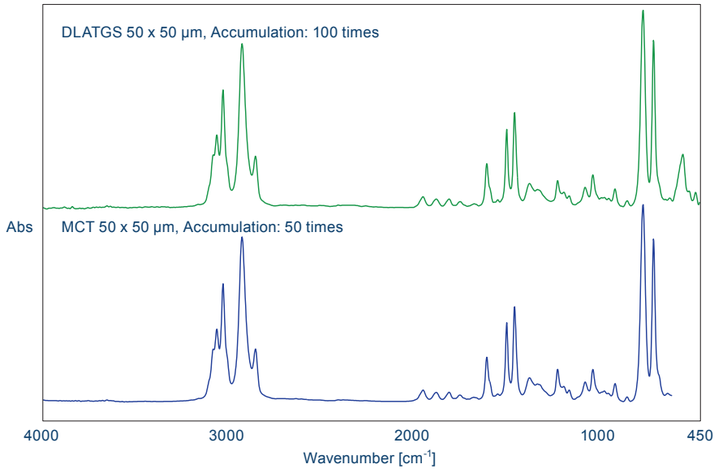
Polarization Image

Detectors

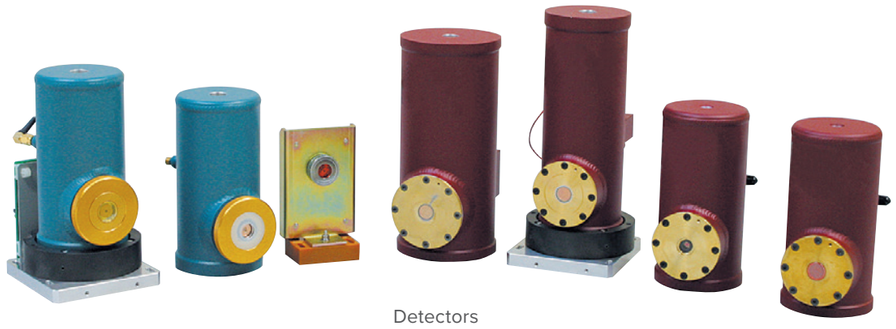
Detectors

The IRT-5000 Series has a choice of standard detectors and a wide range of optional detectors, the IRT-5100 is supplied with a Peltier cooled DLaTGS detector, while the IRT-5200 has a high-sensitivity and wide wavenumber range LN2 cooled mid-band MCT detector. An optional second detector can be installed with either a fixed detector or the SDC-5000 detector-cassette system for interchangeable detectors, these can be selected from a wide range of options. The optional detectors cover the wavelength range from the visible (silicon photodiode, InSb or InGaAs) to mid-IR (narrow, mid and wide band MCT), to far-IR (Si bolometer).

The IRT-5200 can also be upgraded to a 16 element MCT linear array for fast imaging analysis, see details of the IRT-7200 for more details of the linear array options.



Comparison data between DLATGS detector and MCT detector (Sample: polystyrene)



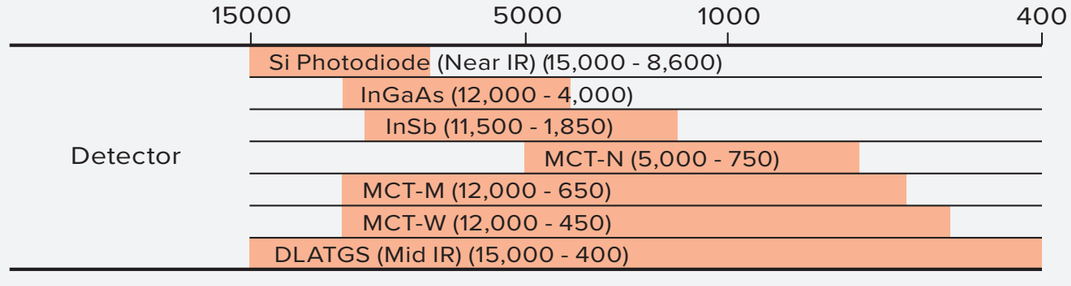
Detectors

Optional Detectors

Listed below are the optional detectors either for installation as a fixed detector or the interchangeable SDC-5000 detector cassette system.

Item	Description
NMCT-5000	N-MCT detector (5,000 - 750 cm^{-1})
WMCT-5000	W-MCT detector (7,800 - 450 cm^{-1})
TGS-5000	DLATGS detector (7,800 - 400 cm^{-1})
INSB-5000	InSb detector (15,000 - 1,850 cm^{-1})
IGA-5000	InGaAs detector (12,000 - 4,000 cm^{-1})
User exchangeable detector	
NMCT-5000C	N-MCT detector (5,000 - 750 cm^{-1})
WMCT-5000C	W-MCT detector (7,800 - 450 cm^{-1})
TGS-5000C	DLATGS detector (7,800 - 400 cm^{-1})
INSB-5000C	InSb detector (15,000 - 1,850 cm^{-1})
IGA-5000C	InGaAs detector (12,000 - 4,000 cm^{-1})
SDC-5000	Modification kit for user exchangeable detector

**When upgrading to the linear array detector, please contact us.*



Spectra Manager™

Micro Measurement

The IRT-5200 includes Spectra Manager Micro-Imaging Analysis Software with IQ Mapping as standard (these are both options on the IRT-5100).

Spectra Manager Micro Measurement Program

The Spectra Manager micro measurement program includes a standard image (single field image) and a multi-image, which provides a broad area image synthesized from a collection of standard images obtained using the automatic XYZ stage.

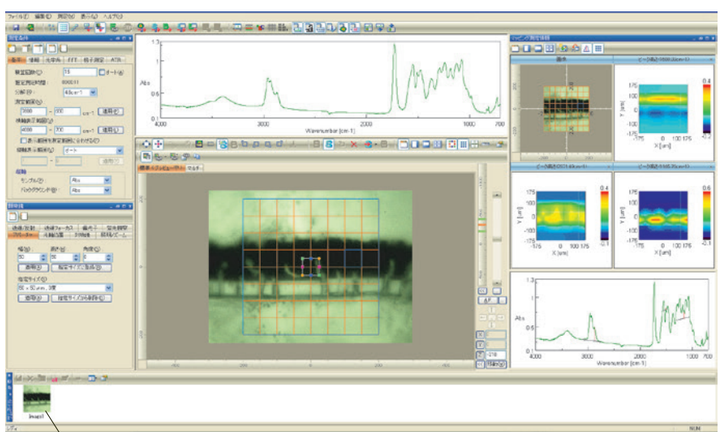
IQ Mapping is used to measure either selected points or an area map on the microscopic image. For ease of operation IQ Mapping can be controlled by the optional joy stick. During mapping measurement, the spectrum being acquired together with a functional group mapping image can be displayed in real-time.

Permanent Record of Spectrum and Sample Image

The measured spectral data which is linked with the microscopic image can be saved as a file, each data process utilizing the measurement data and the microscopic image is available when performing the analysis.

Easy Navigation

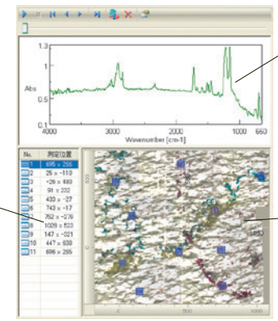
Being able to quickly find or return to a measurement point is extremely important. Navigation around the sample image is made easy with the tools available in the measurement program. When using the automatic XYZ stage a measured position can be registered as a thumb-nail image, the stage can be easily returned to any registered position by simply clicking the thumbnail. In addition, the observed image can be quickly centered by double-clicking a position on the microscopic image.



Spectra Manager Micro
Imaging Analysis

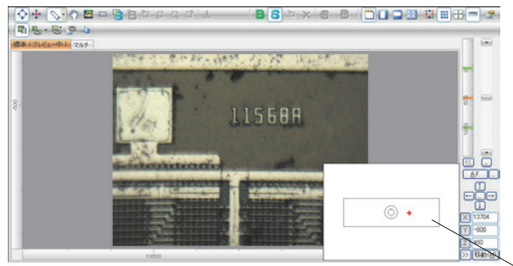
Spectrum Recording

When selecting sample positions for spectral measurement, the user will typically survey the microscope image to identify and select suitable measurement locations. The spectrum recording function lets the user navigate the sample, simultaneously view a pre-measurement spectrum, and then store the selected points to be measured. This function allow the user to quickly survey an entire sample to select the most suitable measurement points before executing a fully automated data acquisition.



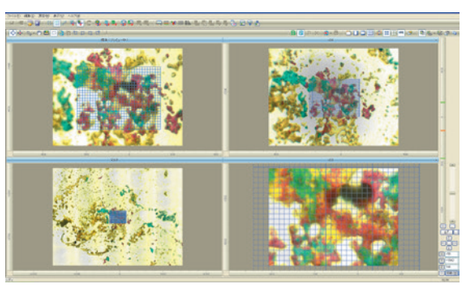
Sub-Map Display

By using the sub-map which is created as an illustration of the sample holder, the user can immediately identify the current position of the automatic XYZ stage. In addition, the coarse positioning of the stage is made by double-clicking an arbitrary position on the sub-map. An observed image can be pasted onto the sub-map, so that the user can see the pictures of the entire stage and the position of any target.



Multi-Window Display

By displaying a zoom image and a multi-image simultaneously, the user can view the entire image and a detailed image in a single view, so that the measurement range can be easily set.



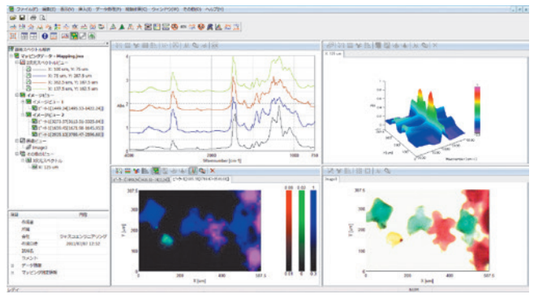
Spectra Manager™ Imaging Analysis

The Spectra Manager imaging analysis program has many powerful data processing functions for spectra, but also it includes tools for creating and viewing a chemical image. The user can intuitively create a chemical image by simple cursor-operation in the viewed spectrum and peak height or peak area are used to identify and visualize the distribution of functional groups.

In addition, the analysis program can search for peaks automatically. Therefore, even if the user does not want to manually interpret the spectrum, the following can be used to easily create a chemical image.

- Chemical image contrast adjustment
- Chemical image creation by comparing with standard data
- Pioneering approach to chemical image creation using PCA and MCR

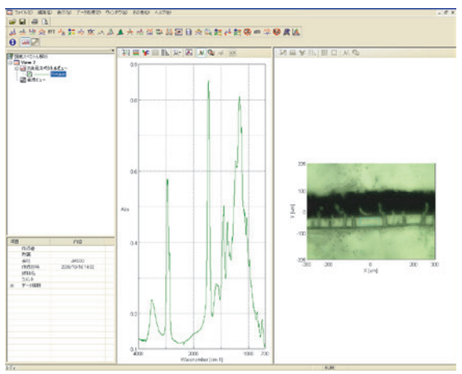
The chemical image, analysis program has the necessary function, which include overwriting, overlay with a microscopic image and fine adjustment of the color.



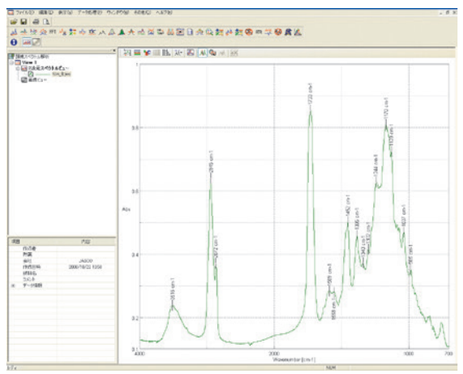
Analysis Program

Save and Analysis of a Single Spectrum

A spectrum can be selected from a mapped image and displayed in a window as a single spectrum using drag-and-drop with the mouse cursor. A single extracted spectrum can be used for conventional data processing (peak detection etc.) and spectral search performed using KnowItAll®.



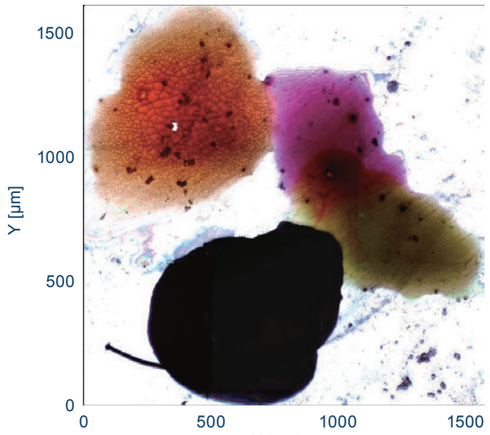
Save Data



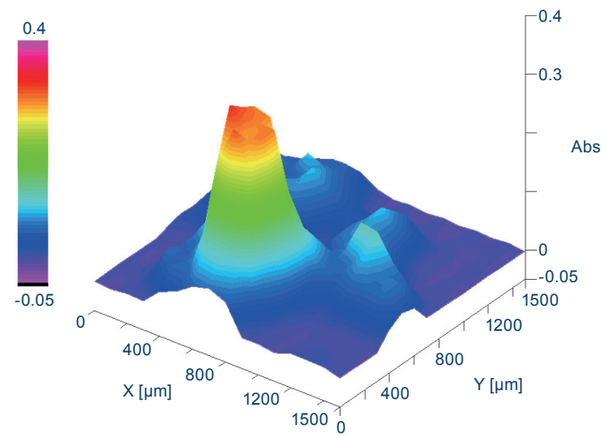
Analysis (peak detection)

Chemical Image Display

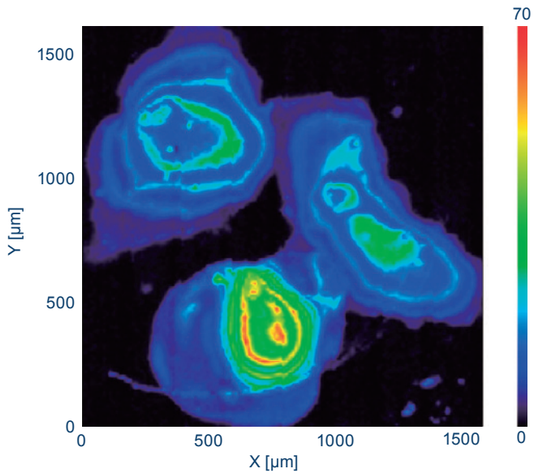
The analysis program can display the chemical image in a range of styles for the user to easily see the location of functional groups within the sample. A 3D display can be rotated using the mouse. A color-coded RGB diagram or a contour map can be overlaid on the microscopic image.



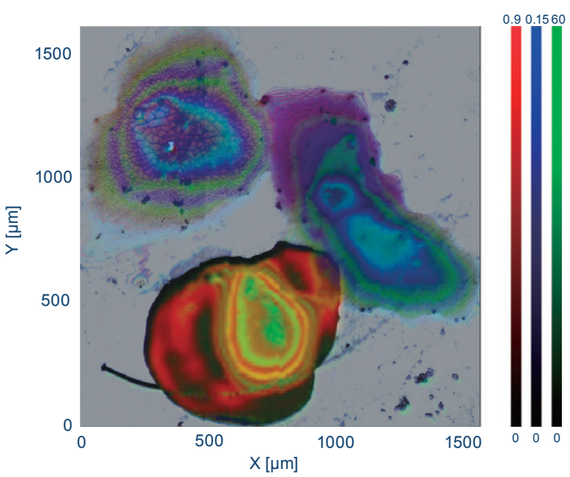
Observation View



Color 3D View



Color-Coded image

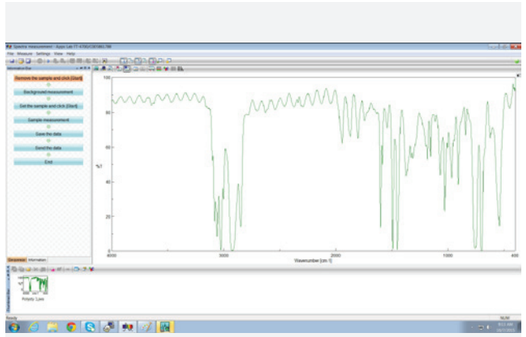


Overlay View of Observation View and Color-Coded Image

Spectra Manager™ Software Suite

Instrument Control

Drivers are included to control each JASCO spectroscopy system. Parameter dialogs allow easy editing of pre-saved parameter files. Data acquired from each instrument is automatically loaded into the analysis program to free up the PC and control software to acquire more data during post acquisition processing. Each instrument driver also has its own dedicated application for instrument hardware diagnostics and validation.

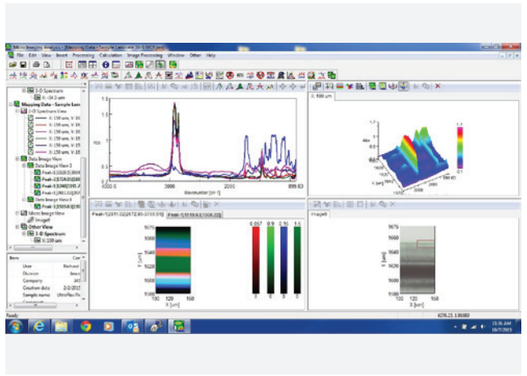


Flexible Display Features

User-friendly features include overlay printing in colors and patterns, autoscale mode, full control of style and font, with customizable workspace and toolbars.

Data Processing and Spectral Analysis

View and process several types of measurement data files (CD, Polarimetry, Raman, UV-visible/NIR, FTIR, Fluorescence, etc.) in a single window, using a full range of data processing functions. Features include arithmetic operations, derivatives, peak detection and processing, smoothing (several methods) and baseline and spectral corrections.

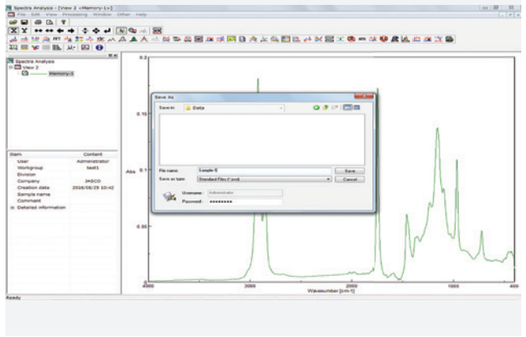


Report Publishing

JASCO canvas is used to create layout templates of spectral data and results to meet individual reporting requirements.

Data Security with Spectra Manager™ CFR

Spectra Manager™ CFR provides secure access and compliance with 21 CFR Part 11. System access requires a username and password, which are assigned by the Workgroup Manager. Individual levels determine the access to administrative tools, which includes instrument installation, analysis application installation, user setup, workgroup setup and security policies, as well as system and application history logs. Three levels of electronic signatures are included: creation, review and approval. An audit trail is included for every data file, recording all processing analysis and reporting of spectral data.



SSE-4000: Secondary Structure Estimation

The amide region of a protein IR spectrum changes slightly according to changes in its secondary structure. SSE-4000 is used to estimate the protein secondary structure using either a PCR or PLS method with reference data sets correlated with the results of X-ray structure analysis. Samples can be measured either in liquid or solid phase (crystal and amorphous), which can be difficult for structural analysis using X-ray and CD. In addition, an IR imaging version of the SSE program can be used with IR microscopy for the analysis of protein secondary structure distribution.

SPECTRA MANAGER™

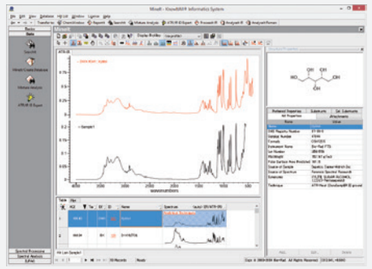
A SINGLE PLATFORM FOR EVERY INSTRUMENT.

JASCO has developed the unique and powerful, cross-platform Windows® software package to control the widest range of optical spectroscopy instrumentation. Spectra Manager™ is a comprehensive lab companion for measuring and processing data, eliminating the need to learn multiple software programs and allowing data from many instruments to be analyzed and displayed together on the same platform.

KnowItAll® JASCO Edition Spectral Search

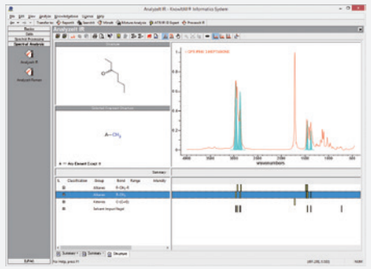
Sadtler's KnowItAll® Informatics System, JASCO Edition is included* with FT/IR-4000 and 6000 series instruments. This comprehensive data search database and analysis software includes the following features:

- Free access to Sadtler databases, including 264,000 IR spectra (HaveItAll®), for 90 days after software activation and with unrestricted access to the Sadtler data library including 12,000 spectra of reagents and polymers for life
- Search JASCO's own data library including 400 spectra of organic and inorganic compounds



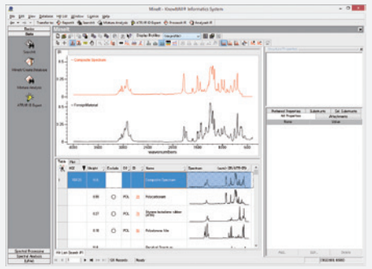
SearchIt™

Search against reference databases as well as your own imported spectra. Searches are customizable and driven by powerful algorithms. Searchable fields include name, structure, substructure, properties, and analytical data, such as spectra and peaks.



AnalyzeIt™

Interpret the bands in an infrared spectrum. Simply load a spectrum and click on a peak of interest to generate a list of possible functional groups at that position. AnalyzeIt features over 200 functional groups and hundreds of interpretation frequencies.

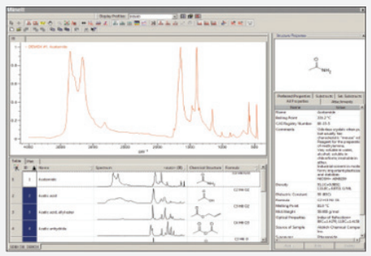


Mixture Analysis

Determine the components in a mixture. Just transfer the spectrum to be analyzed, the software searches and compares the samples to reference databases of known compounds and predicts the possible mixture of components.

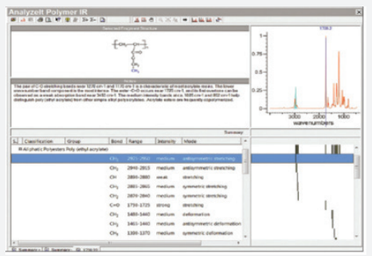
ID Expert™

ID Expert automatically performs a series of basic analyses, single and multi-component search, peak search, and functional group analysis.



MineIt™

Searchable databases can be built for IR and NIR, chemical structures and other metadata. Databases can be customized for users needs. Convenient for QC labs.



AnalyzeIt™ Polymer IR

Useful in the identification of IR spectra of unknown polymers, classification/pattern characterization of polymers.

*Except LE versions

The KnowItAll® spectral database of 264,000 sample spectra is segmented into 120 easy to search individual libraries.

Polymers & Related Compounds: total 52,055 spectra
- ATR-IR - Polymers:
- IR - Adhesives, plasticizers, polymers etc.

Pure Organic Compounds: total 166,545 spectra
- ATR-IR - Standards
- IR - Standards
- IR - Alcohols, aldehydes, carboxylic acids, hydrocarbons, intermediates, vapors etc.

Industrial Compounds: total 21,975 spectra
- IR - Fats, Waxes & Derivatives
- IR - Lubricants, additives, solvents and petroleum products
- IR - Surfactants

Forensic Sciences: total 21,635 spectra
- ATR-IR - Controlled & Prescription Drugs, Pharmaceuticals, Nutraceuticals
- ATR-IR - Steroids and hormones
- IR - Biochemicals, Abused drugs, dyes, explosives, fibers, flavors
- IR - Canadian Forensics, Georgia State Crime lab

Environmental Application: total 6,350 spectra
- IR - HAZMAT
- IR - Pesticides, agrochemicals,

Inorganics and Organometallics: total 2,560 spectra
- ATR-IR - Inorganics, organometallics
- IR - Inorganics, organometallics, minerals and clays

NIR: total 3,800 spectra
- NIR - Common Organic Compounds

Optional Accessories

Diamond Cell

DC-500

For transmittance measurement with IR microscopy where the sample is too thick to obtain good transmittance spectra, the sample can be compressed using a diamond cell exerts pressure on the sample. This accessory is used with a variety of sample types, such as monofilaments, polymer materials, rubber products, hair, biological tissue etc.

Specification	
Holder Size	25 x 75 x 12.2 mm
Diamond Size	2.5 mm dia., thickness: 1 mm
Effective Diameter	2 mm dia.

Diamond Window

JDW-200/300

For transmittance measurement with IR microscopy, to obtain a good spectrum, the following conditions are required.

- Sample thickness less than 10 µm
- Surface at measurement point is flat

The diamond window has hardness far superior to KBr which is often used, so that even for hard samples, the JDW-200/300 can crush and stretch sample for better spectra.

Specification			
Holder Size	13 mm dia	Refractive Index	2.38 (1000 cm^{-1})
Material	Synthetic diamond IIa tye with high quality (Impurity content: less than 0.5 ppm)	Hardness	10 (Mohs hardness)
Parallelism (arc. min.)	Less than 5	Diamond Size	JDW-200 2.5 mm dia. x 0.5 (t) mm JDW-300 3.5 mm dia. x 0.5 (t) mm
Surface Roughness	Less than 1 µmRmax		

Heating/Cooling Stage

MHC-5000/7000

For researching the chemical structure of materials, it is very important to obtain information from the IR spectrum that show changes in the phase transition. The heating/cooling system can perform IR spectral measurement while changing the temperature.

Specification	
Heating Stage	
MHC-5000	Ambient to 600°C (-190 to 600°C, option)
MHC-7000	Ambient to 375°C, (-60 to 375°C, option)
Programs	
Measurement Programs	Heating measurement, Temperature control measurement, Time course measurement, Temperature control display
Processing Programs	Smoothing, off-set adjustment, spectral subtraction, auto baseline correction

**Limited by the working distance, only a 10x cassegrain can be used with the manual stage. 10x and 16x cassegrains can be used with the automatic XYZ stage. A 32x condensing/objectives cannot be used.*

Binocular Unit

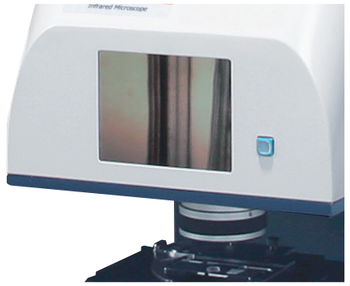
VIS-5000

The IRT-5000 Series includes a high-resolution CMOS camera for observation using the PC monitor as standard. The VIS-5000 binocular unit* can be used for visual operation and includes a 10x eyepiece (with ocular micrometer). With ATOS, the user can observe the area selected by the aperture.

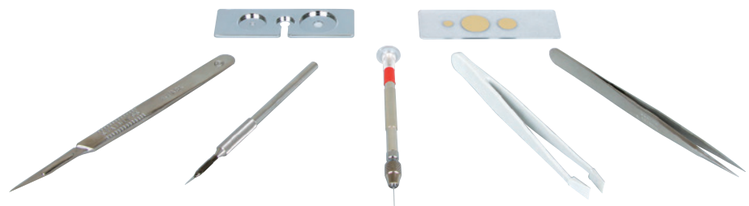
**The binocular unit and color LCD monitor cannot be mounted simultaneously, select as required.*
**VIS-5000 cannot be installed with a vacuum-system.*

Color LCD Monitor

LCD-5000



A 5.7 inch TFT monitor* can be mounted on the IRT-5000 Series to view the microscopic area. When using the manual stage, it can be controlled while viewing the monitor, for easy target positioning and focusing. ATOS is used to observe the area selected by the aperture.



Sampling Kit

The sampling kit includes a range of convenient tools for selecting contaminants and handling materials. They can also be used for setting the sample on the microscope slides or sample mounts.

**Following sampling kit is included in IRT-5000 Series as standard.*

Optional Accessories

SliceMaster

Precision Cutting from 10-200 microns

The SliceMaster is a convenient and compact slicer that can create thin sections quickly and easily. It is a powerful tool for multi-layer film analysis and/or cross sectional analysis. Four models are available, and can be selected according to the requirements of sample preparation.

HS-1 Vertical Slicer

Easily cuts samples vertically for cross-section observation

HK-1 Angled Slicer

Observe wide cross-sections of samples with thin layers such as coatings.
(Approximately 4 times as wide as a vertical cross-section area)

HW-1 Multi-Angle Slicer

Variable cutting angle for cross-section observation of small samples

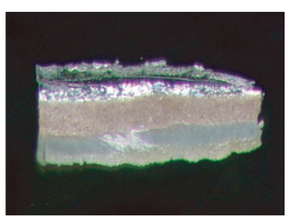
TS-1 Tablet Slicer

For clean cutting fragile samples (such as tablets, cereal grains etc.).
Variable angle cutting

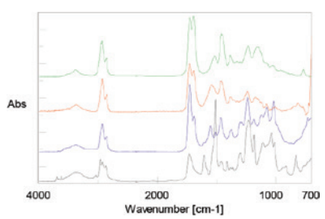
Analysis of Coating Layers from an Automobile

This application shows the results of micro FTIR transmission measurement (KBr plate method) of a sliced film coating. Since the film coating is fragile, it is difficult to obtain a cross-section. In this case, a cross-section was made by heating the sample using a hair dryer. An HK-1 slicer was used to cut a thin cross-section of the sample, which was used for component analysis with high accuracy.

Fragment of coating film



Cross-section

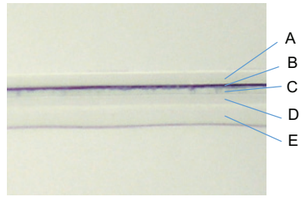


Transmission spectrum of each layer

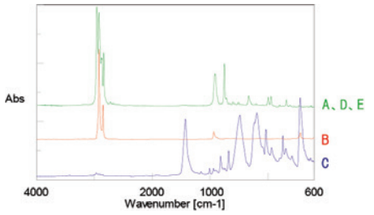
Analysis of a Multi Layer Film

This application shows the results of micro FTIR transmission measurement (KBr plate method) of a sliced food packaging bag. The HS-1 slicer can cut a clear cross-section for component analysis with high accuracy.

Food packaging bag (multi-layer film)



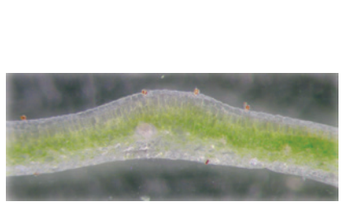
Cross-section



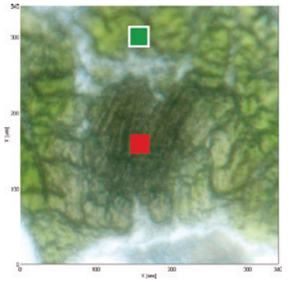
Transmission spectrum of each layer

Cross-Sectional Analysis of a Soft Sample

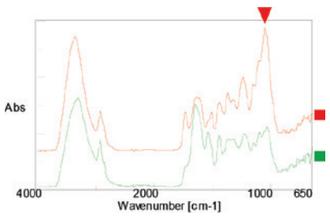
This application shows the results of micro FTIR transmission measurement (KBr plate method) of a sliced plant leaf. A double-edged blade (thin-type) was used to cut the soft material.



Observation view



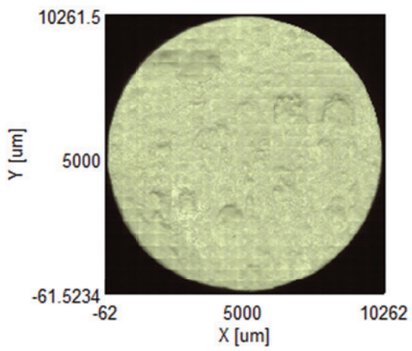
Observation view (Zoom)

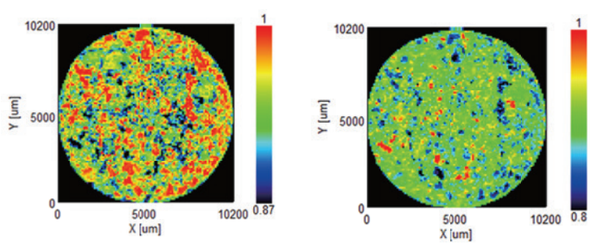


Spectrum of each target

Cross-Sectional Analysis of Tablets

This application shows the result of mapping measurement of a sliced tablet using a micro FTIR. The TS-10 cuts the tablet horizontally to obtain the component distribution with exceptional accuracy.





Left: Observation view
Center: Distribution of medicinal component
Right: Distribution of additive components

Purge and Vacuum Microscopes

Vacuum System (IR Microscope and FTIR main unit)

Vacuum Optics and Isolated Stage Compartment

For measurements in which a spectrum may be affected by atmosphere components such as water vapor or carbon dioxide, purging of the interferometer and sample chamber with dry nitrogen offers significant improvements in data quality. However, using the optional vacuum IRT-5000 is a much more effective way to eliminate the influence of atmospheric gases.

**The IRT-5000 vacuum model should be configured with a vacuum FTIR spectrometer. In addition, an automatic vacuum panel (AVC-600) is required.*

Sample Chamber Purge Case

PGC-5000

The optical system of the IRT-5000 Series microscopes include nitrogen purge as standard. For more efficient purging, the microscope can also be supplied with an optional purge case to enclose the sample stage, this dramatically improves the quality of data by minimizing the influence of water vapor and carbon dioxide.

**When upgrading to the linear array detector, PGC-5000UPG is required*

Related Instruments

IRT-7200

Imaging measurement is essential for analyzing/visualizing the chemical structure of a sample. Conventional IR microscope with the single-element detector is typically used, this has the disadvantage that the measurement time can be very long . The IRT-7200 uses a 16-channel linear array MCT detector with high-speed XYZ autostage, and is able to perform high-speed mapping measurement, up to hundred times faster than a single-element detector.

Observation Mechanism	Direct through system, CMOS camera, With 3x optical zoom, IQ Monitor Option: Built-in type color LCD monitor, Binocular
Detector	Linear array mid-band MCT detector, Single-element mid-band MCT detector
Objective Mirror/Condenser Mirror	16x or 32x Option: 10x
ATR	Option
Objectives Switching Mechanism	4-position motor-driven revolver With automatic recognition mechanism
Measurement Time (when using the linear array detector)	1.6 sec. (FT/IR-6000, 100 x 100 µm, pixel resolution: 6.25 µm2, resolution: 16 cm-1, Accumulation: 1)
Sample Stage	XYZ autostage (with auto focus)
Aperture	Automated vertical/horizontal adjustment, and angle of rotation
Control Panel	Standard

IRT-1000

IRT-1000 is an in-compartment microscope for the measurement of micro-sized samples typically as small as 50um or 20um with DLaTGS or MCT detectors respectively . The compact integrated design includes all of necessary functions of an IR microscope, resulting in small size , light-weight and low-price IR microscope. The IRT-1000 microscope can be mounted in the sample compartment of the FTIR main unit easily in the same way as the other IR accessories.

Photometry	Transmission/Reflection
Observation Mechanism	CCD camera, Built-in type 5 inch color LCD monitor, ATOS mechanism, Smart monitor
Detector	The detector which FTIR instrument is equipped with
Objective Mirror/Condenser Mirror	8x
ATR	Option
Sample Stage	XYZ manual stage
Aperture	Automated vertical/horizontal adjustment
Control Panel	Standard

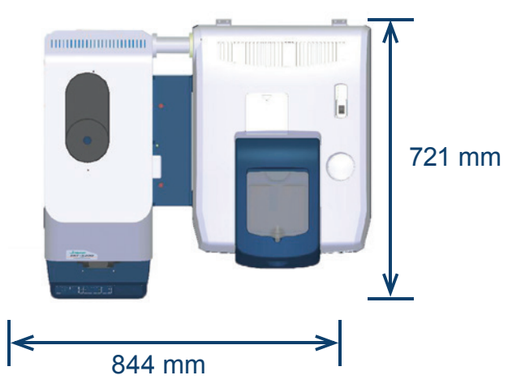
Specifications

Model	IRT-5100	IRT-5200
Applicable FTIR Main Unit	FT/IR-4000 series, FT/IR-6000 series	
Measurement	Transmission, reflectance, ATR and Graxing Angle Reflectance	
Observation Mechanism	Direct through system	
Detector	DLaTGS detector (7,800 - 400 cm-1)	Mid-band MCT detector (7,800 - 600 cm-1)
Optional Detectors	Narrow-band MCT detector (5,000 - 750 cm-1) Wide-band MCT detector (7,800 - 450 cm-1) DLATGS detector (7,800 - 400 cm-1) InSb detector (15,000 - 1,850 cm-1) InGaAs detector (12,000 - 4,000 cm-1) Linear array mid-band MCT detector (7,000 - 650 cm-1) (1 x 16 elements) Linear array mid-band MCT detector (7,000 - 650 cm-1) (2 x 16 elements) Linear array InSb detector (10,000 - 1,900 cm-1) (116x elements) Linear array InGaAs detector (10,000 - 5,000 cm-1) (116x elements) *When upgrading to linear array detector, please contact us.	
Liquid Nitrogen Holding Time	-	Approx. 15 hours *1 (Mid-band MCT detector)
Detector Switching	Up to 2 detectors (Software switching) Option: User exchangeable detector (cannot be used with Linear array detector)	
Signal-to-Noise Ratio	1,500:1 (aperture size: 300 µm2, resolution: 4 cm-1, accumulation: 2 min, around 2,200cm-1)	8,000:1 (aperture size: 100 µm2, resolution: 4 cm-1, accumulation: 1 min, around 2,200cm-1)
Observation	IQ Monitor (simultaneous sample measurement and observation.) CMOS camera (3M pixels): with x3 optical zoom (x0.6 - x2) Option: color LCD monitor, binocular eyepiece *The binocular unit and the color LCD monitor cannot be mounted simultaneously The binocular unit cannot be mounted to the vacuum type IRT-5000.	
Observation Illumination	High-intensity white LED (with auto brightness function)	
Objective Mirror	Cassegrain: 10x, 16x or 32x (Switching by motor-driven turret)	
Objective Lens	Option: x4, 10x and x20	
Objective Selector	4-hole motor-driven turret, with automatic objective recognition mechanism	
Condenser Mirror	Cassegrain: 10x, 16x or 32x *2 (Switching by manual)	
Automatic Condenser Mirror Adjustment	Standard	
Aperture	Automated vertical/horizontal adjustment, and angle of rotation	
Sample Stage	Manual stage Movable distance: X: 70 mm, Y: 50 mm, Z: 20 mm	
Optional Auto Stage	Automatic XYZ stage Movable distance: X: 100 mm, Y: 75 mm, Z: 25 mm (1 µm step) Maximum load: 5 kg (maximum), 500 g (standard) With auto focus function Optional Joystick (for controlling IQ Mapping and automatic XYZ stage)	
Purge	Available (Purge case: option)	
Vacuum Option	Factory option *IRT-5000 vacuum system includes an automatic XYZ stage as standard. please contact us about field upgrade, .	
Control Panel	Transmittance/reflectance switching, mode indicator, detector indicator, objective switching/indicator, aperture opening/closing/rotation, measurement start/stop, condenser mirror auto adjustment, brightness adjustment Option: Pressure sensor indicator	

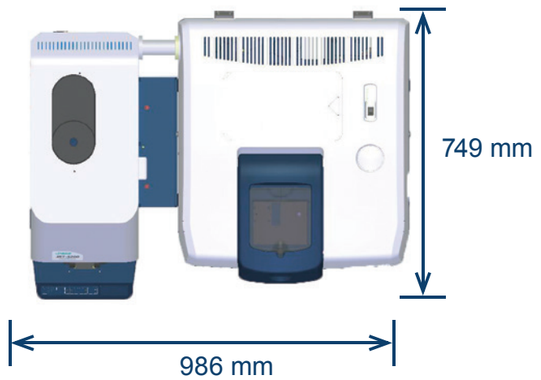
ATR Measurement	Option *3: Cassegrain ATR or transmission type ATR is available.	
RAS Measurement	Option: RAS-5000 and IR polarization measurement unit are required.	
IR Polarization Measurement	Option: Polarizer is inserted into light path angle control	
VIS Polarization Observation	Option: Polarizer is inserted manually. *VIS polarization observation unit for vacuum system is factory option only.	
Differential Interference Contrast Observation	Option: Compatible with objective lens observation *10x objective lens and a VIS polarization observation unit are required.	
Fluorescence Observation	Option: Two models are available depending on wavelength	
Dimension/Weight	587 (H) x 302 (W) x 695 (D) mm, 54 kg	
Power Requirement	AC 100 - 240 V, 50/60 Hz, max. 60 VA	
Standard Function Programs		
IQ Mapping	-	Area mapping without stage movement, ATR mapping, Line measurement, Multi-point measurement
Automatic XYZ Stage Control (when mounting auto stage)	Stage movement, Centering, Area mapping, ATR mapping, Line measurement, Multi-point measurement, Auto focus, ATR pressure control, Multi ATR mapping	
Multi Image (when mounting auto stage)	Allows a broad area image to be synthesized from several standard images (Maximum acquisition area is the movable area of the automatic XYZ stage), The measurement area can be set within the displayed area.	
Real-Time Display	Spectrum, Chemical image of specified wavenumber, Measurement point on the microscopic image	
Data Processing	Peak height, Peak height ratio, Peak area, Peak area ratio, Peak shift, FWHM, Distance measuring, Imaging model analysis, Mapping analysis	
Image Display	Color 3D diagram, Bird's-eye view, Spectrum contour map view, Spectrum color-coded diagram, 3D spectrum, 2D spectrum view, RGB display, Overlay display	
Optional Program		
IR Mapping SSE Analysis	Available	

*1 "Liquid nitrogen holding time" is the initial value when installing the instrument.
*2 The objective mirror and the condenser mirror of the same magnification are supplied.
*3 ATR mapping can be performed when using the cassegrain ATR. The mapping software of the transmission type ATR is option. (ATR mapping and Smart mapping are not available when using transmission type ATR)

IRT-5200 System Configurations



Combined with FT/IR-4000 Series



Combined with FT/IR-6000 Series

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