C103-E103

SHIMADZU
Excellence in Science

Infrared Microscope

AIM-9000

Finally, a wide view on micro sample analysis

SHIMADZU AIMs to provide analysis systems for all users.

The system is automated to ensure all steps involved in micro analysis can be performed quickly and easily.
All our accumulated know-how in micro analysis is concentrated in the AIM-9000 to strongly support analysts.

Three steps for micro analysis

Observe	Measure	Analyze
Visible 330× digital zoom	Automatic contaminant recognition system	Contaminant analysis program


SHIMADZU
AIM-9000
AUTOMATIC INFRARED MICROSCOPE

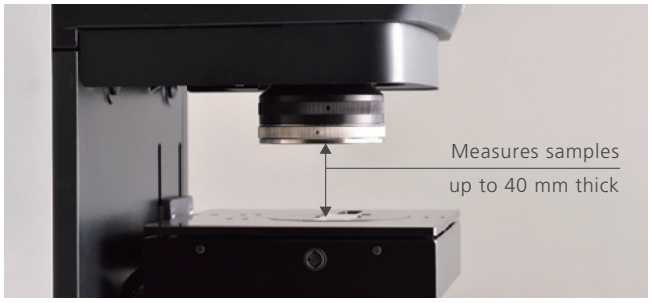
A Series of Smooth Micro Analysis

Load

Load Sample

Loading Samples Is Easy

Pressing the [Eject Sample] button makes it easy to load and remove samples by automatically lowering the stage and switching the objectives to expand space.
Furthermore, the lower Condenser mirror can be removed to enable reflectance/ATR measurements of samples up to 40 mm thick.



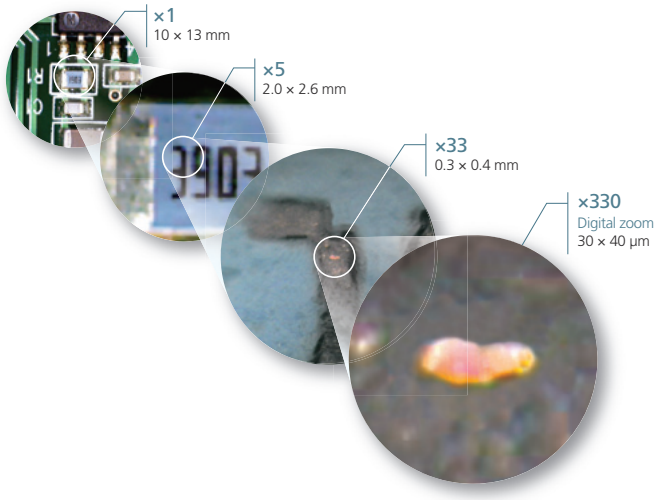
Observe

Look for the Item to Be Measured

Quickly Determine the Measurement Position — Wide-Field Camera* and Microscope Camera —

Shimadzu's proprietary wide-field camera and microscope camera help observe samples efficiently. In addition to observing a large area up to 10 × 13 mm, the wide-field camera also supports variable digital zooming. Furthermore, by sharing positional information with the microscope camera, it achieves a digital zoom function capable of zooming to a magnification of about 330× for observing extremely small areas as small as 30 × 40 µm. (The microscope camera supports variable digital zoom magnifications up to 10×.)

* The wide-field camera (P/N 206-32605-41) is optional.



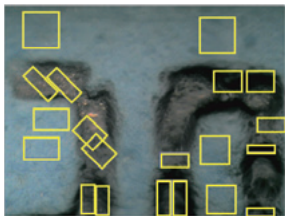
Golden contamination adherent on metal plate

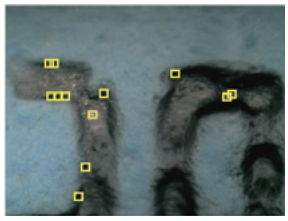
Measure

Determine Where to Measure, and Measure Automatically

Automatically Determine Measurement Positions — Automatic Contaminant Recognition System —

A function that automatically recognizes contaminants is included standard. The analyst simply clicks one button and the software automatically recognizes the contaminant. It even determines the optimal aperture size and angle in only one second.
Two models are available: the standard model and a model optimized for extremely small areas. Users can choose the best model for their application. The automatically determined measurement positions can either be measured without editing or the analyst can add or delete measurement positions. Sample images are stored into the measured spectra automatically.
The sample and measurement positions can be easily identified later.


Standard


Micro

Analyze

Identify the Cause of Failures

Automatic Identification of Contaminants — Contaminant Analysis Program —

The contaminante analysis program-the functionality for automatically qualifying contaminants is included as a standard feature in LabSolutions IR software. Measured spectra using AIMsolution can be loaded directly into LabSolutions IR and analyzed.

The contaminant analysis program identifies measured contaminants with high precision using a spectral library for substances commonly detected as contaminants in combination with Shimadzu's proprietary identification algorithm (patent pending).

Contaminant Analysis Program Features


It includes spectra for over 550 inorganic substances, organic substances, and polymers commonly detected in contaminant analysis.


It not only searches for spectra, but it also applies a special algorithm focused on spectral characteristics.


Searching for spectra, determining matches, and preparing reports are all automated.


Even for contaminants that are mixtures, it searches for primary and secondary components and also displays the probability of candidate substances.

Functionality That Is Simpler and More Convenient to Use

Perform Infrared Measurements Smoothly While Viewing Visible Images - Visible/Infrared Dual View System -

Infrared spectra can be measured while checking a visible image of the sample. Spectra can be measured while confirming the position of contaminants, which avoids the trouble of switching back and forth between the visible light and infrared light.
Used in combination with the tiling function, visible observations and infrared measurements can be performed anywhere within the stage operating range, which does not need to reposition the sample.

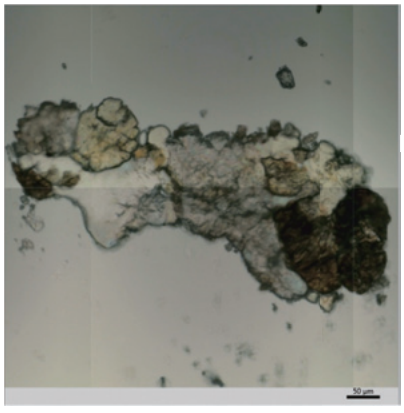
Image view of the visible light and infrared optical path
- Green light: visible light optical path
- Red light: infrared optical path

Visualize Components - Chemical Imaging* -

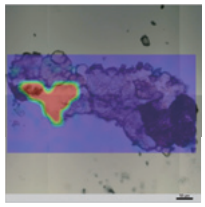
The invisible distribution of chemicals can be visualized based on peak height or area, multivariate analysis (PCR/MCR), or spectral similarity to target spectra.

Chemical image of pharmaceutical powder

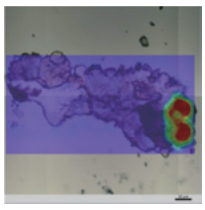
Rolled pharmacuetical products with a diamond cell and then mapping measured.
Right figure represents the distribution of powder components, such as lactose, lipid, and cellulose.
Color display can be switched freely between single-color and multi-color.



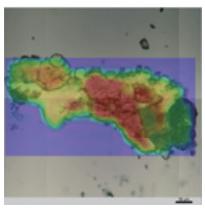
Microscopic image of pharmaceutical powder



Distribution of lactose
O-H stretching
(Around 3526 cm^{-1})

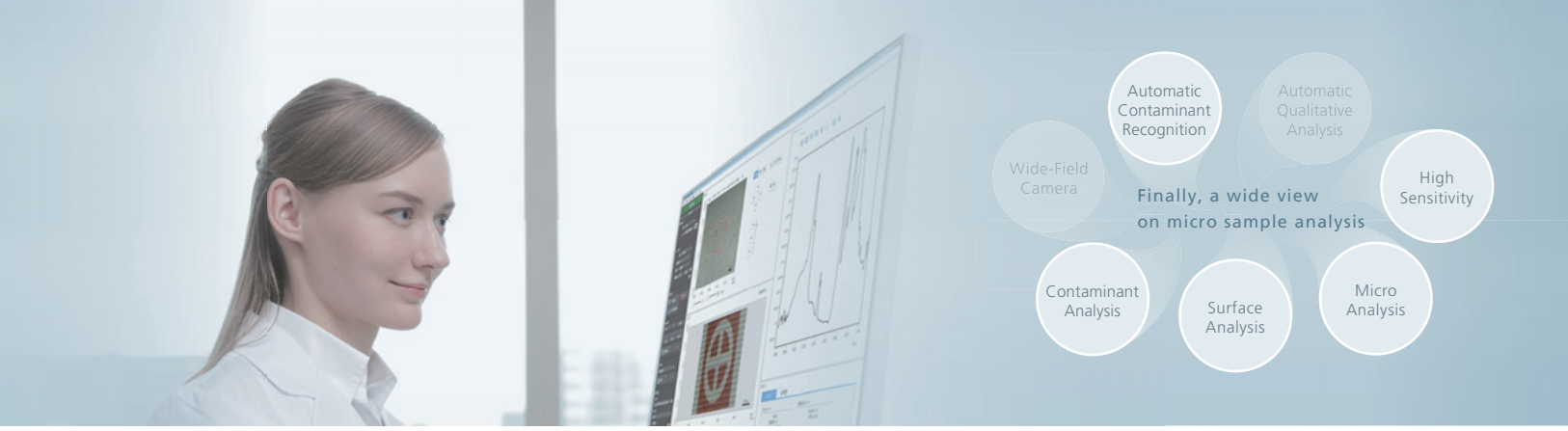


Distribution of lipid
C-H stretching
(Around 2855 cm^{-1})



Distribution of cellulose
C-O stretching
(Around 1060 cm^{-1})

* Visualizing chemicals requires an optional mapping program (P/N 206-98427).

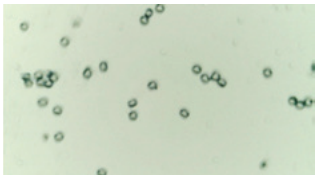


Perform Ultra Micro Analysis - Best-in-Class Signal-to-Noise Ratio -

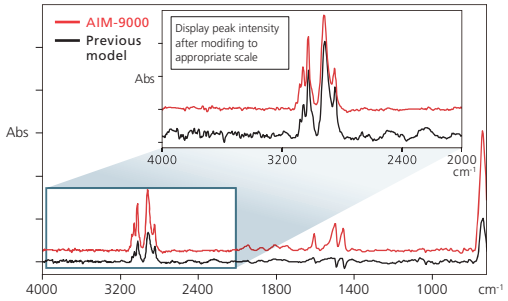
The AIM-9000 optimized for measuring extremely small areas. The AIM-9000 achieves 30,000:1 signal-to-noise ratios, the best in its class. Consequently, it can quickly obtain excellent spectra from even extremely small contaminants.

Transmission measurement of polystyrene beads

A ø10 µm polystyrene bead was measured by transmittance method. Low noise and high quality spectrum of very small sample was obtained with only small number of scan.



Sample : 10 µm diameter polystyrene bead on BaF_2 window plate
Measurement Condition : Aperture size 15 × 15 µm
Number of Scans : 40 (about 20 seconds)

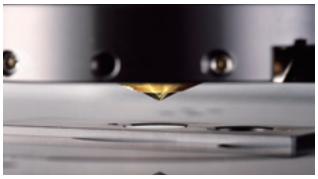


Perform High-Sensitivity ATR Measurement - Samples with High Refractive Index -

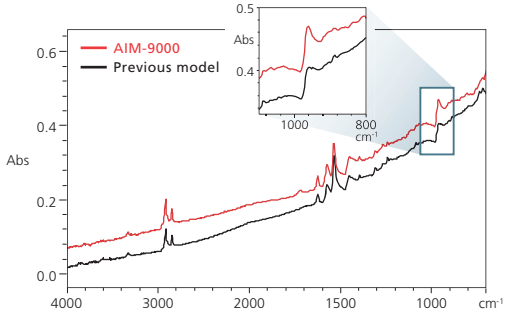
The Ge prism (P/N 206-32600-41) has an anti-reflective coating that provides high sensitivity for over 50% higher throughput.
Due to a steeper incident angle for the infrared light, compared to the previous model, the AIM-9000 is able to acquire excellent distortion-free ATR spectra even when measuring samples with a high refractive index, such as black rubber.

ATR measurement of black rubber

An acrylonitrilebutadiene rubber (NBR) with 50 wt% carbon was measured by Ge-ATR objective. A clear peak of C=C-H out-of-plane bending mode was obtained at 970 cm^{-1}, which was strained by conventional ATR objective.



Sample : NBR with 50 wt% carbon content
Measurement Condition : Aperture size 50 × 50 µm
Number of Scans : 20 (about 10 seconds)



Fully Support Identification of Contaminants
- Tap Water/Food Contaminants Library and Thermal-Damaged Plastics Library* -

Tap Water/Food Contaminants Library (P/N 206-30390-91)

This unique library was created by Shimadzu especially for analyzing contaminants in tap water and food products. The library includes information about samples actually collected as contaminants and service parts commercially marketed for tap water applications. It also includes a collection of X-ray fluorescence profiles (PDF files). Consequently, it can significantly improve the precision of contaminant searches. Unlike the previous libraries, this is a mixture library that covers the extensive knowledge and experience necessary for qualitative analysis.

Thermal-Damaged Plastics Library (P/N 206-33039-91)

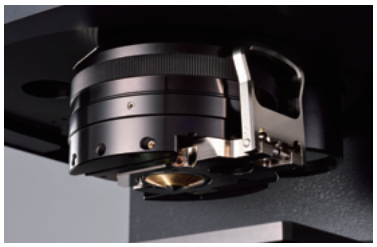
This unique library includes information about plastics that have degraded due to oxidation by heating. The library is especially useful for analyzing degraded contaminant substances, which are common.

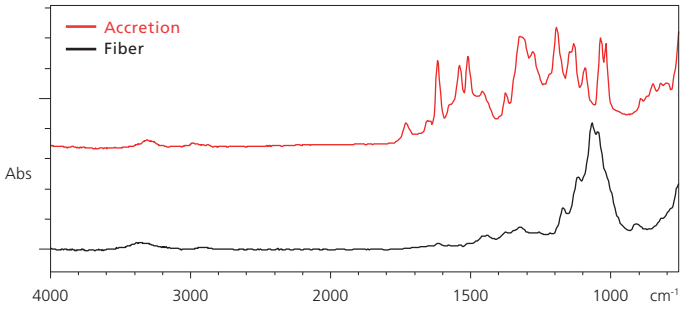
* Shimadzu create the library using spectra obtained by Hamamatsu Technical Support Center, Industrial Research Institute of Shizuoka Prefecture.

Accessories

ATR Objective (slide-on type) Ge prism: P/N 206-32600-41 ZnSe prism: P/N 206-32601-41

The ATR objective uses a cone-type prism, with single reflection, 15× magnification and a 45-degree incident angle. The slide-on type prism makes it easy to switch back and forth between visible observation and infrared measurement. This ATR objective is especially effective in analyzing samples that do not transmit or reflect infrared light easily, such as paper and plastics, or extremely thin film, such as stains.





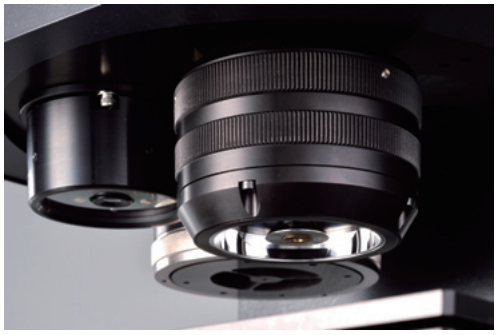
Spectra of contaminants on a textile Identified as Phenolic resin

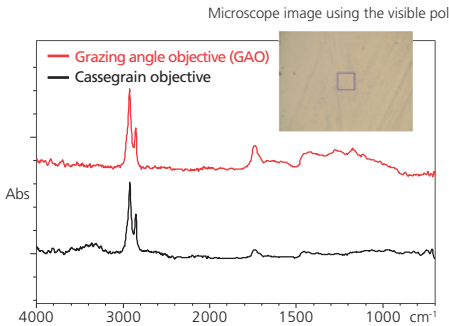
ATR Pressure Sensor P/N 206-32603-41

This pressure sensor prevents prism damage due to excessive pressures applied during ATR measurements using an ATR objective. It can also be used to automatical ATR measurement with pressure sensing.

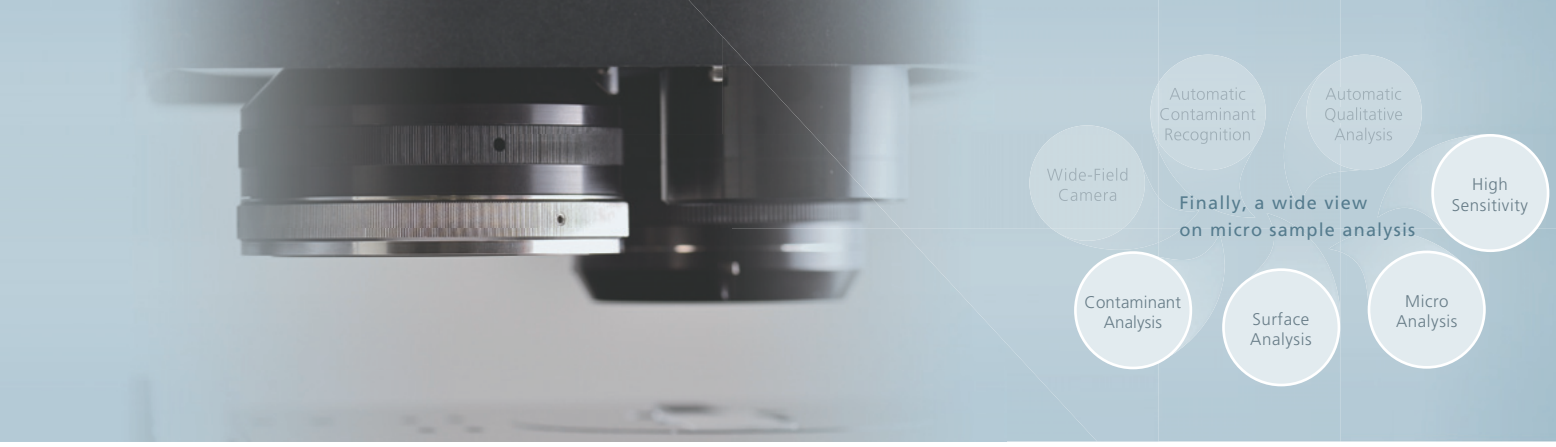
Grazing Angle Objective (GAO) P/N 206-32602-41

The Grazing angle objective with 80-degree incident angle is effective for measurement of organic thin film with nm level on metal substrate. In case of failure analysis, this objective is useful for measurement of samples on the concave surfaces or stains on metal surface.



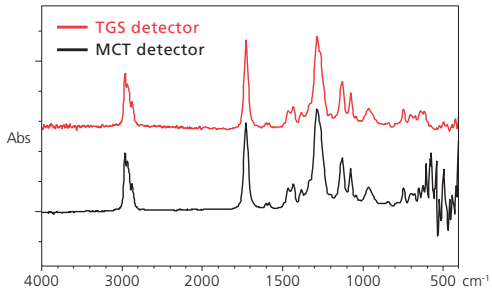


The infrared spectra of stains on the metal (oil film)



TGS Detector P/N 206-32580-41

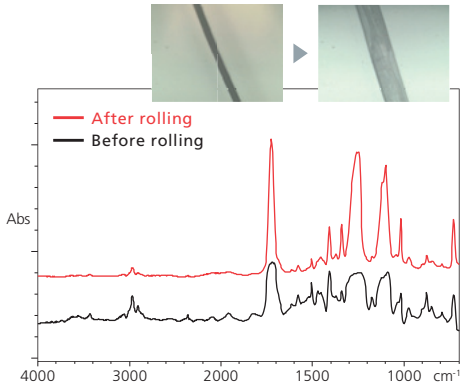
By adding this TGS detector to an AIM-9000 infrared microscope, infrared spectra can be obtained without liquid nitrogen. It is also possible to switch back and forth between the MCT and TGS detectors for measurements as needed. The TGS detector offers a wider wavenumber range (up to 400 cm^{-1}) than the MCT detector, but with lower sensitivity. Therefore, the MCT detector is used to measure micro samples less than 100 µm.



The infrared spectra of the polyvinyl chloride (PVC)

Diamond Cell CII P/N 208-92289-01

This diamond compression cell is used to compress micro samples very thin for direct measurement under the microscope. It can be used for samples such as plastics and fibers. This CII cell features a large thin window plate made of artificial diamond (1.6 mm diameter). A type-B cell that uses natural diamond is also available.



The infrared spectra of single fiber

Infrared Polarizer P/N 206-32605-41

This accessory is useful for researching the orientation characteristics of samples, or increasing sensitivity with Grazing Angle Objective measurements. The infrared polarizer can be used by inserting it into the microscope from the side.

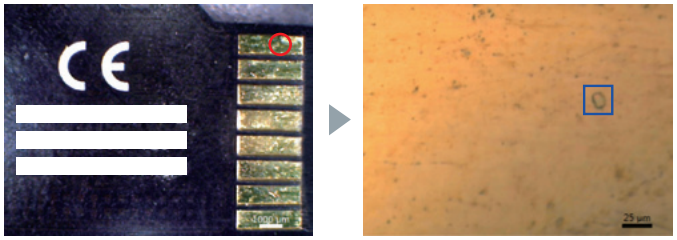
Visible Polarizer P/N 206-32540-41

This accessory is useful for visible observation of samples that are normally difficult to observe using visible light. Using the properties of polarized light can make samples easier to see.

Application Examples in Specific Fields

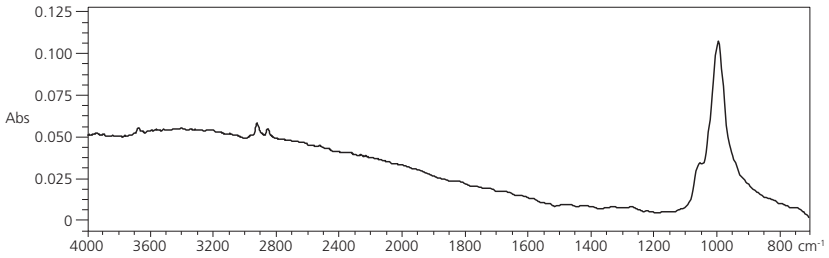
Electrical and electronic

This is an analysis example of foreign matter attached to the terminal of the electronic parts. By using a wide view camera, observing the entire part of the parts and deciding where to measure can be smoothly done. When a good spectrum is difficult to be provided by the reflection measurement such as thin stain or small alien substances, ATR spectroscopy (Ge prism) is effective.



Observation image of the whole electronic parts by the wide view camera

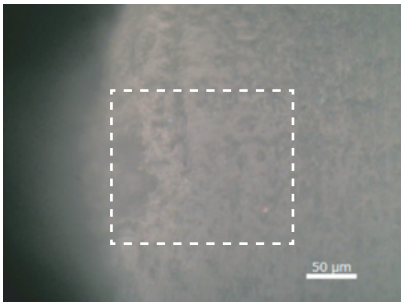
Observation image of the foreign matter on the terminal by 15× Cassegrain objective mirror.



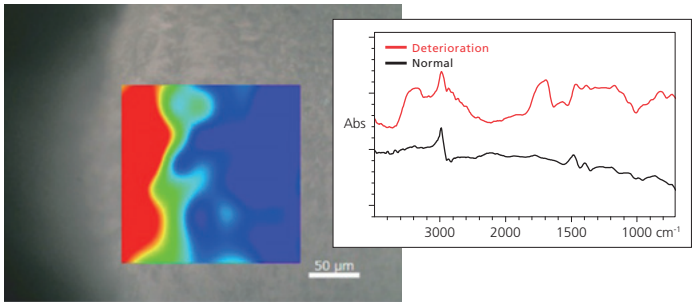
Spectrum of the foreign matter acquired by reflection spectroscopy It is estimated to be silicate. Identified as Silicate

Machinery and Transportation

This is a example of resin parts exposed to sunlight for long period.
By measuring the infrared spectrum of the component cross section, the progress degree of the degradation about depth direction from the surface can be visualized.



This sample had been exposed to the sunlight from the leftside.

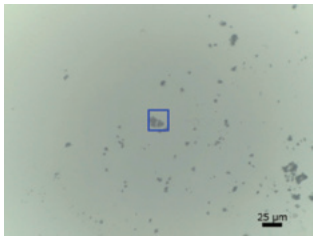


Imaging in the area of the C = O peak indicating oxidation degradation

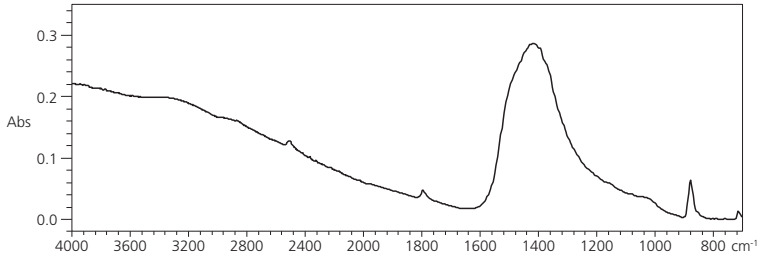
Pharmaceutical and Life

This is an analysis example of foreign substances adhering to the surface of a pharmaceutical tablet. By being taken to a diamond cell and rolled, transmission measurement can be performed to various shaped samples.

Observation image of the tablet surface of 8 mm in diameter with the wide view camera (2× zoom)



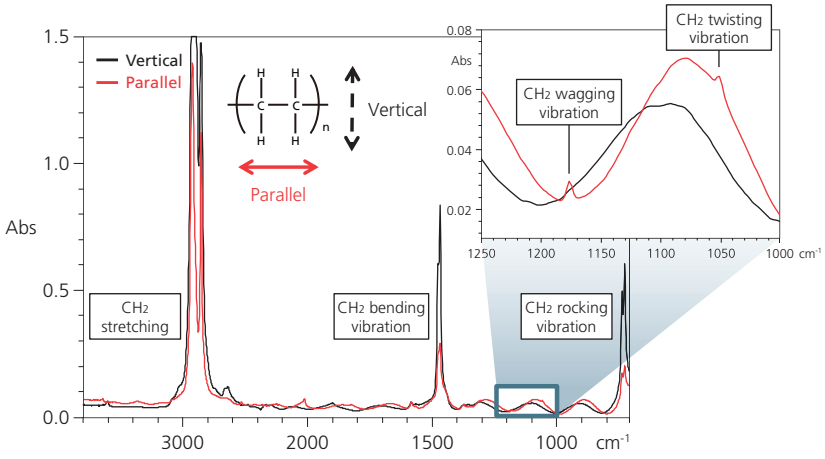
Observation image of the foreign matter on the diamond cell by 15× Cassegrain objective mirror.



Spectrum of foreign matter collected in the diamond cell Identified as Carbonate

Petroleum and chemical

This is the polarizing analysis of a film.
By using the infrared polarizer, polarization property and orientation of the film can be evaluated.



Specifications

Hardware

Measurement Mode	Transmission/reflection/ATR
Optical System	15× Cassegrain objective 15× Cassegrain condenser
MCT Detector	Wavenumber range: 5,000 to 700 cm^{-1} (narrow band) 5,000 to 650 cm^{-1} (middle band) Liquid nitrogen monitoring function: Includes a liquid nitrogen sensor with a liquid nitrogen level indicator
TGS Detector (Option)	Wavenumber range: 4,600 to 400 cm^{-1} Automatically switches between detectors, if equipped with multiple detectors
Supports for Observation and Measurements	Auto Focus Automatic adjustment function for Condenser mirror Observation of samples during measurements (only with ZnSe prism in case of ATR measurements) Automatic ATR measurement (with purchase of pressure sensor)

Options	Wide-field camera (independent illumination from four directions) ATR objective (ZnSe, Ge) ATR pressure sensor Grazing angle objective (GAO) Infrared polarizer Visible polarizer
Installation Conditions	Environmental requirements for performance warranty: 15°C to 30°C with max. 70%RH (and no condensation) Site requirements: 15°C to 30°C with max. 70%RH (and no condensation) Or max. 60%RH when 30°C is exceeded
Power Voltage	100/120/220/230/240 V AC
Power Requirements	125 VA

Software

Computer Requirements	OS: Microsoft Windows 7 Professional 64bit RAM: 8 GB or more Monitor resolution: Min. 1920 × 1080 pixels
Measurement Support Functions	Automatic aperture setting (automatic contaminant recognition system) Zoom function (max. 330× digital zoom) Multi-image tiling Up to 60 aperture settings can be specified on microscope or tiled images.
Validation	Japanese Pharmacopoeia European Pharmacopoeia Chinese Pharmacopoeia Confirmation of aperture size
Option	Mapping program

Data Processing	• Baseline correction (zero/3-point/multi-point) • Advanced ATR correction • Atmospheric correction • Kramers-Kronig analysis • Differential analysis • Mapping chemicals based on calculation formula • Mapping chemicals based on principal component analysis • Mapping chemicals based on similarity to reference spectra • Spectral search • Importing reference spectra • Pasting spectra and images into other applications

Examples of Combined Systems

IRTracer-100 +AIM-9000

IRAffinity-1S +AIM-9000

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