

Infrared Microscope

AIMsight





SHIMADZU AIMs to

provide analysis systems for all users.

AIMsight™

An automatic analysis system that can be used with confidence from your first analysis

Equipped as standard with enhanced functionality to support analyses



Observe

Wide-field camera



Measure

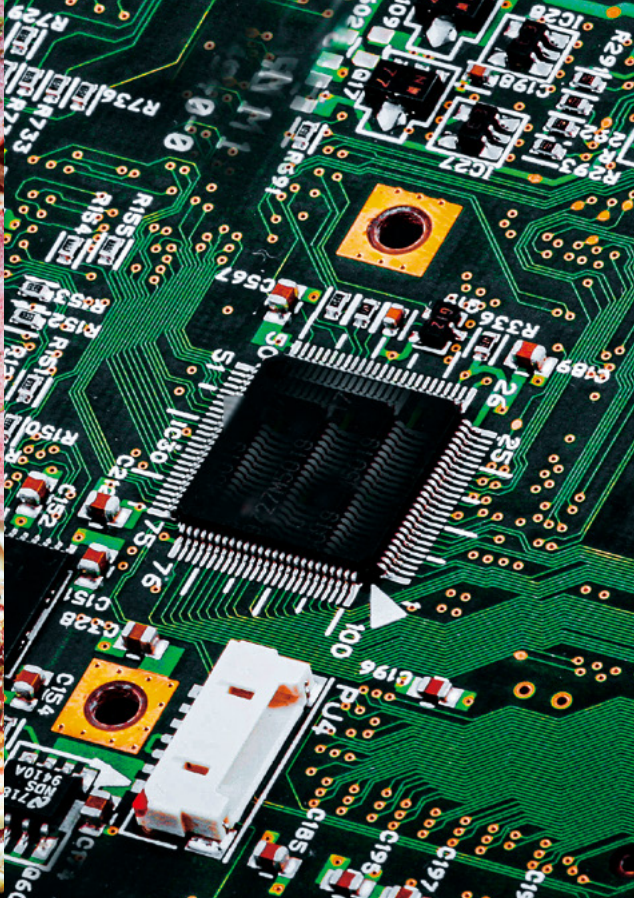
Automatic contaminant
recognition system
Highest class S/N
Length measurement function



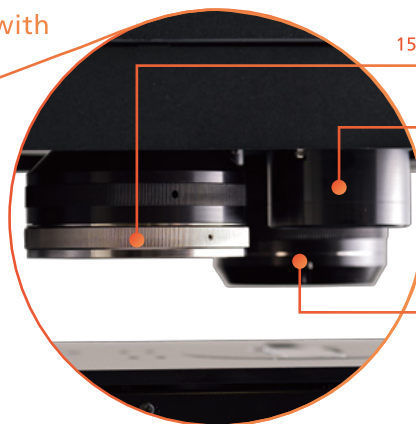
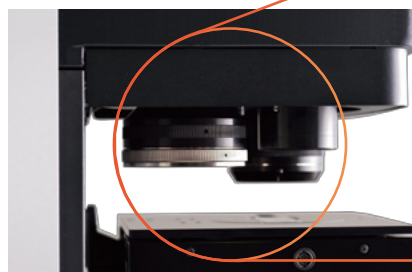
Analyze

Original library of high hit ratios*
Contaminant analysis program
Spectrum advisor function

*Optionally available



Determines the measurement position smoothly by capturing the measurement target with a wide field of view

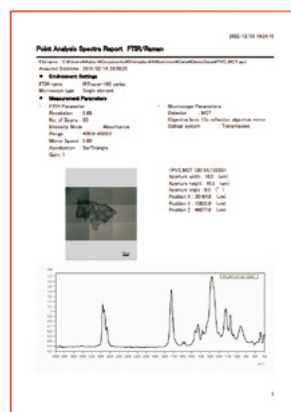
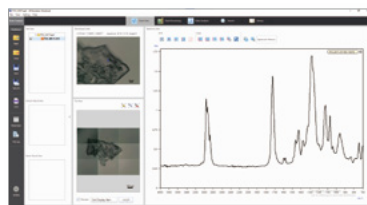


15x reflective objective mirror

Wide-field camera

Grazing Angle Objective (optional)

Exports the measurement results



Powerful support for an efficient analysis workflow

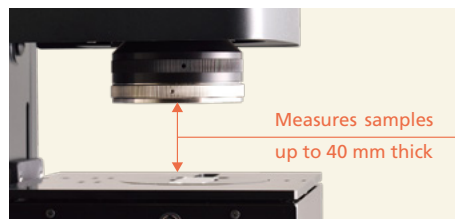


Observe

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.

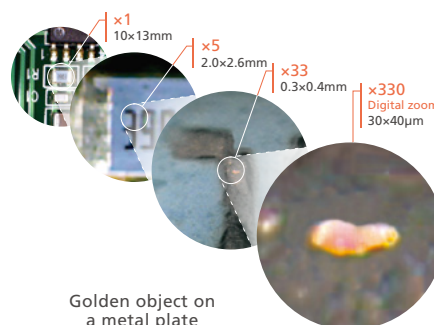


Look for the Item to be Measured

Quickly Determine the Measurement Position

Wide-Field Camera and Microscope Camera

The 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 areas as small as 30 × 40 μm. (The microscope camera supports variable digital zoom magnifications up to 10×.)



Golden object on a metal plate



Measure

Determine Where to Measure, and Measure Automatically

Software automatically recognizes objects.

Automatic Contaminant Recognition System (refer to page 8)



ANALYTICAL INTELLIGENCE



Analyze

Identify the Cause

Automatic Identification of Objects

Contaminant Analysis Program



ANALYTICAL INTELLIGENCE

The contaminant analysis program - the functionality for automatically qualifying objects - 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 objects with high precision using a spectral library for substances commonly detected as contaminants in combination with Shimadzu's proprietary identification algorithm (Patent: JP 5205918). Even if objects are mixtures, the system searches for the primary and secondary components, and displays the probability of the substances identified. It is not necessary to specify the number of components in the mixture, so analysis is easy, even for people with little experience with infrared analysis.

Fully Supports Identification of Objects

Original library of high hit ratios (optional)

Contaminant Library for LabSolutions IR (P/N 206-33179-91)

This unique library was created by Shimadzu especially for analyzing contaminants in tap water and food products. The library includes information about samples 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 qualitative accuracy of the objects. Unlike previous libraries, this is a mixture library that covers the extensive knowledge and experience necessary for qualitative analysis.

Thermal-Damaged Plastics Library*1 P/N 206-33039-91 / UV-Damaged Plastics Library*2 P/N 206-31808-41

These unique libraries include information about plastics that have degraded due to oxidation by heating or Ultraviolet rays. The libraries are especially useful for analyzing degraded objects, which are common.

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

*2 Plastics which were degraded for 10 years worth by using an Iwasaki Electric super accelerated weathering tester were measured and compiled as a library by Shimadzu Corporation.



Measure

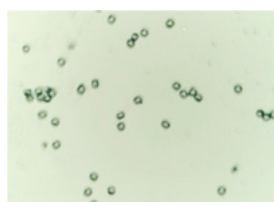
Perform Ultra Micro Analysis

- Best-in-Class S/N Ratio -

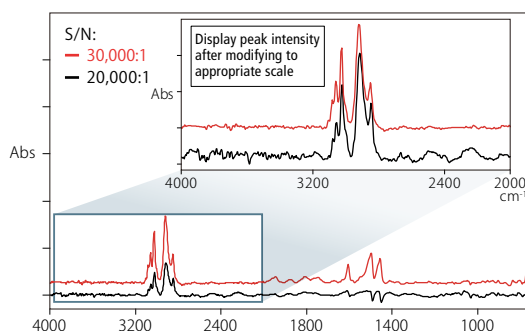
The AIMsight has been optimized to measure extremely small areas. The AIMsight achieves a 30,000:1 S/N ratio, the best in its class. Consequently, it can quickly obtain excellent spectra from even extremely small objects.

Transmission measurement of polystyrene beads

A $\phi 10\ \mu\text{m}$ polystyrene bead was measured by the transmission method. Low noise and a high-quality spectrum of a very small sample were obtained with only a small number of scans.



Sample : 10 μm diameter polystyrene bead on BaF₂ window plate
 Measurement Condition : Aperture size 15 \times 15 μm
 Number of Scans : 40 (about 20 seconds)



Transmission spectra of 10 μm diameter polystyrene bead obtained by two infrared microscopes with different noise levels.



Measure

High-Sensitivity ATR Measurement

- Samples with High Refractive Index -

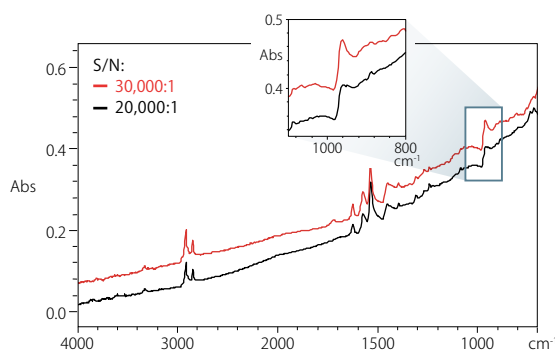
Due to a steep incident angle for the infrared light, the AIMsight is able to acquire excellent distortion-free ATR spectra even when measuring samples with a high refractive index, such as black rubber. In addition, the Ge prism (P/N 206-32600-41) has an anti-reflective coating that provides high sensitivity.

ATR measurement of black rubber

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



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



ATR spectra of NBR with 50 wt% carbon obtained by two infrared microscopes with different noise levels.



ANALYTICAL INTELLIGENCE

- Automated support functions utilizing digital technology, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.



Observe

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 objects, 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, eliminating the 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



Analyze

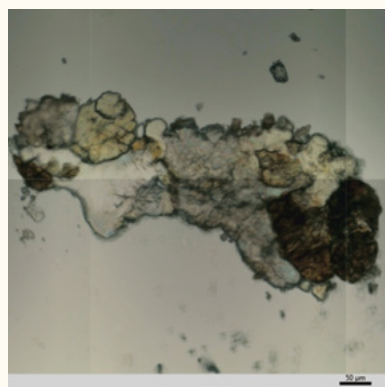
Visualize Components

- Chemical Imaging* -

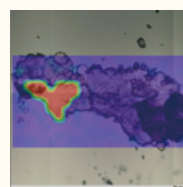
The invisible distribution of chemicals can be visualized based on peak height or area, multivariate analysis (PCR/MCR), or spectral similarity to target spectra.

Chemical image of a pharmaceutical powder

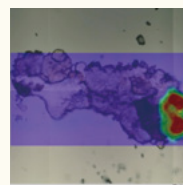
Pharmaceutical products were rolled with a diamond cell, then mapping measurement was performed. The figure to the right represents the distribution of powder components, such as lactose, lipid, and cellulose. Color display can be switched freely between single-color and multi-color.



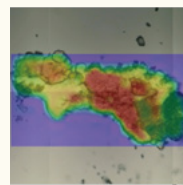
Microscopic image of pharmaceutical powder



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 using an optional High-Speed Mapping Program (P/N 206-36299-41).



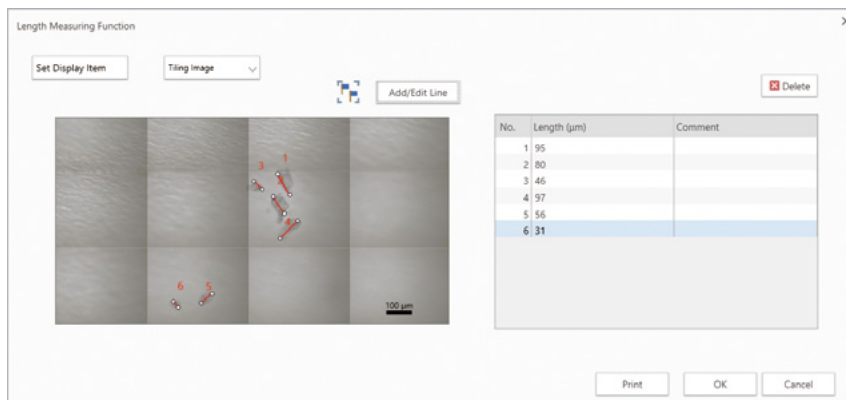
Measure

New

Length Measurement Function

A length measurement function has been added to AMsolution. The length of the target object can now be measured in images obtained with the infrared microscope.

In addition, with a single click, the length measurement results can be output as a report.



Analyze

New

Library Creation Function



Library

A library creation function is included as standard with the AMsolution analysis program. An original library can be created by registering the infrared spectra obtained by the analyst. This library created can be used for searches. Qualitative accuracy is improved by registering materials used in products and the substances handled during the manufacturing process, and using them as a library.



Analyze

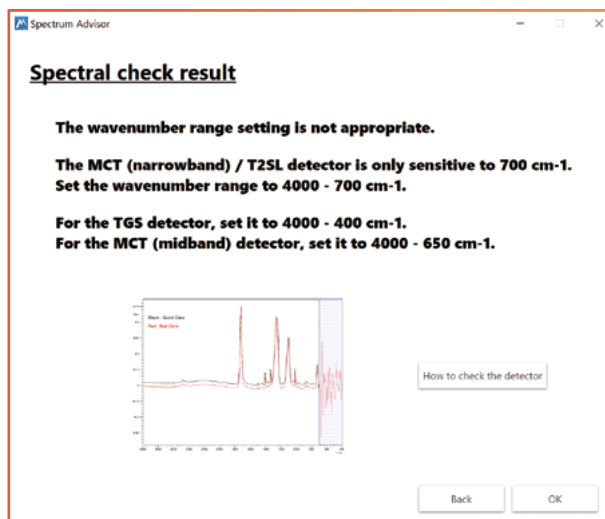
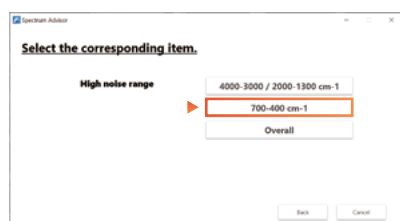
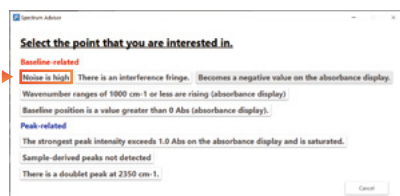
New

Spectrum Advisor Function (patent pending)



ANALYTICAL
INTELLIGENCE

This is packaged with operations specific to infrared microscopes and advice on troubleshooting using accessories. Corrective measures are proposed by comparing the measured spectrum with measurement examples. As a result, better quality data can be acquired.



Hardware Validation

The AMsolution measurement program features a Validation Program to check and confirm the performance of Shimadzu Fourier Transform Infrared (FTIR) spectrophotometers and the Shimadzu AIMSight Infrared Microscope. Validation can be done automatically using a standard polystyrene film with traceability etc. in accordance with the Japanese Pharmacopoeia (JP), US Pharmacopoeia (USP), the European Pharmacopoeia (EP), and Chinese Pharmacopoeia (ChP).

Items conforming to the Japanese Pharmacopoeia, US Pharmacopoeia, European Pharmacopoeia, and Chinese Pharmacopoeia are inspected

- Shape and intensity of power spectra
- Following items of polystyrene film spectrum
 - Resolution
 - Wavenumber accuracy
 - Wavenumber repeatability
 - Transmittance (absorbance) repeatability
 - Peak separation function

Notes:

- Wavenumber repeatability is an inspection item only in the Japanese Pharmacopoeia.
- The peak separation function is an inspection item only in the Chinese Pharmacopoeia.
- The only US Pharmacopoeia inspection item is wavenumber accuracy.

Optional Software

High-Speed Mapping Program

Line and area mapping modes are available for infrared measurement. In addition to typical transmission and reflection mapping modes, an ATR microscope mapping measurement can be selected (which requires an optional ATR objective mirror and pressure sensor). Using the high-speed mapping program, measurements can be performed with the specified number of accumulations at points determined to contain samples based on the spectra^{*1}. Points determined to contain no samples are measured at a single accumulation, which allows faster performance while maintaining the spectra's quality. Using the mapping measurement results, a chemical image can be created based on peak heights/areas, multivariate analysis (PCA/MCR), or similarity to a target spectrum, allowing visualization of the distribution of components that otherwise cannot be confirmed visually.

^{*1} The high-speed mapping function is only available in the area mapping mode for infrared (transmission/reflection) measurements.

KnowItAll® Bundle

Activate John Wiley & Sons, Inc. KnowItAll^{*2} from a button in the LabSolutions IR software to automatically transfer the active spectrum. With KnowItAll, you can perform searches using a rich library, analysis of constituent components and constituent ratios by mixture analysis, and functional group analysis by searching for functional groups of specified peaks.

^{*2} AMsolution does not work with KnowItAll Version 2018 and earlier.

Particle Analysis Program

By adding a particle analysis program to AMsolution, the chemical images obtained from mapping measurements^{*3} can be used to calculate individual particle qualities, as well as the major axis, minor axis, mass^{*4}, and volume^{*4}. In addition, this statistical information can be easily displayed. The program can be used from the [Particle Analysis] tab page, thereby maintaining the same operational setup as the AMsolution analysis software. The particle analysis program can be used for a variety of analyses, including the analysis of microplastics and contaminant analysis.

^{*3} The optional High-Speed Mapping Program is separately required.

^{*4} Mass and volume are calculated based on the theoretical formula (Formula (1) $[\log_{10}(M)=b \cdot \log_{10}(S)+a]$) used in the article referenced below. This theoretical formula applies only to microplastics. Shimadzu cannot guarantee the validity of the mass results.
Tomoya Kataoka, Yota Iga, Rifqi Ahmad Baihaqi, et al. Geometric relationship between the projected surface area and mass of a plastic particle. Water Research. 2024;261:122061.

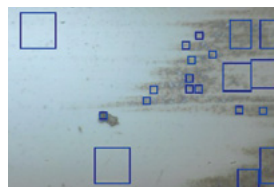


Measure

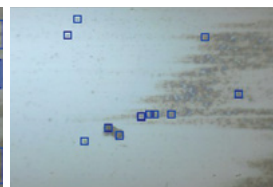
Automatic Contaminant Recognition System



Functionality for automatically recognizing objects is included standard. The analyst simply clicks one button for the software to automatically recognize objects. Two types are available: the standard type or the micro type for extremely small areas, which can be selected based on the purpose of analysis. Samples can either be measured with the automatically selected measurement positions left unchanged or the analyst can add or delete measurement positions. A sample image is automatically saved for each measured spectrum. That makes it easy to confirm the sample or measurement positions later.



Standard Type



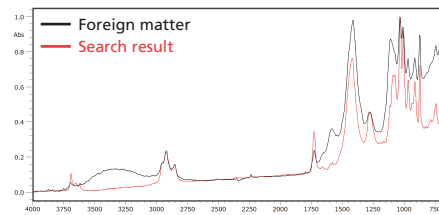
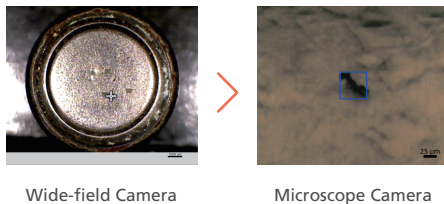
Micro Type

Electronics and Electronic

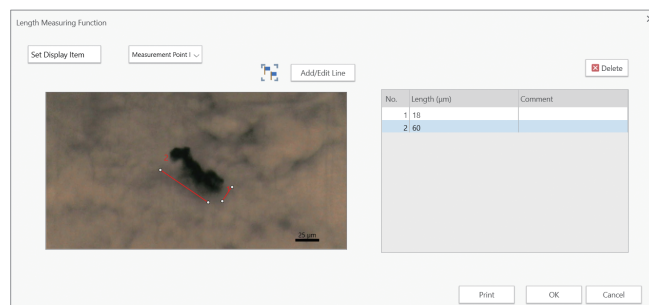
For more details,
click here.

Application News No.01-00456

Shown here is an example of analyzing foreign matter adhering to the surface of a button battery. By using the wide-field camera, it is possible to observe entire components and determine measurement points quickly. We performed the analysis using the direct ATR measurement method. A search of the obtained data using the Shimadzu Original Contaminant Library revealed that the foreign matter consisted mainly of acrylonitrile butadiene rubber (NBR) and contained CaCO_3 , aluminum silicate (KAOLIN) and phthalates as additives. Before the measurement, the length of the foreign matter was measured using the length measurement function. As a result, we found that the foreign matter adhering to the button battery surface was 18 μm on the short side and 60 μm on the long side.



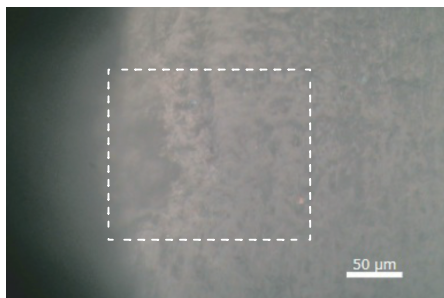
ATR spectra of foreign matter adhering to button battery surface and comparison of components hit by search



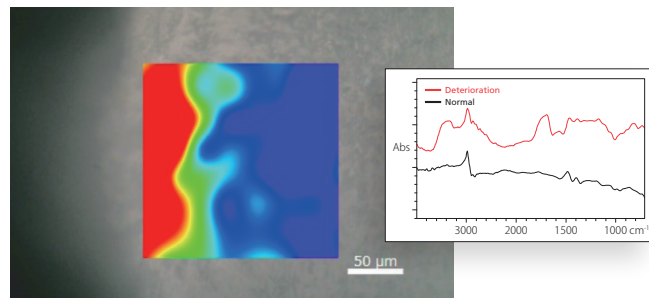
Measurement screen using length measurement function

Machinery and Transportation

This is an example of analyzing resin parts exposed to sunlight for a 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 left side.



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

Pharmaceutical and Life Science

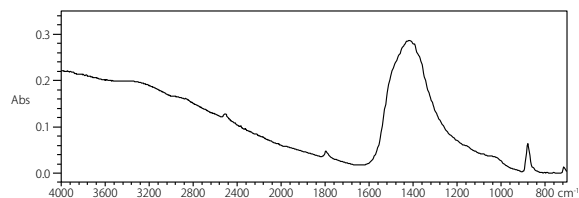
This is an examples of the analysis of foreign matter adhering to the surface of a pharmaceutical tablet. By being taken to a diamond cell and rolled, transmission measurement can be performed on various shaped samples.



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



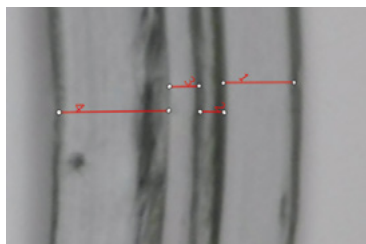
Observation image of the foreign matter on the diamond cell by 15x Cassegrain objective mirror.



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

Material

This is an analysis example of multilayer film used in potato chip packaging. Sections of the film were cut with a microtome and measured by the transmission method. We also measured the thickness of each layer using the length measurement function. From the inside touching the chips, each layer was found to be 27 μm polypropylene (PP), 9 μm PP + polyethylene (PE), 11 μm polyethylene terephthalate (PET), and 42 μm PE.

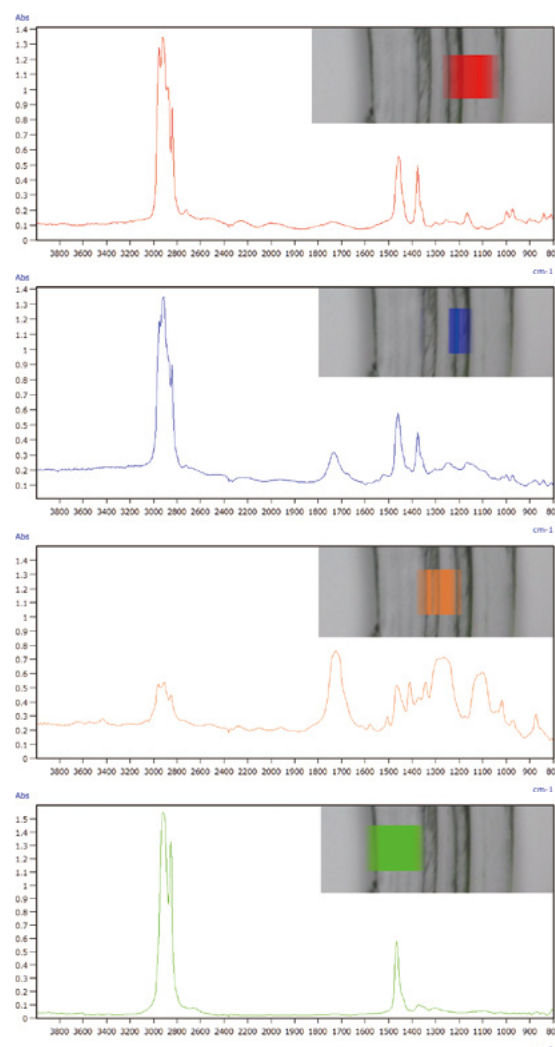


Photographs and length measurement results of multilayer film cross sections (inside on left side of screen)

No.	Length(μm)
1	27
2	9
3	11
4	42

For more details,
click here.

Application News No.01-00455



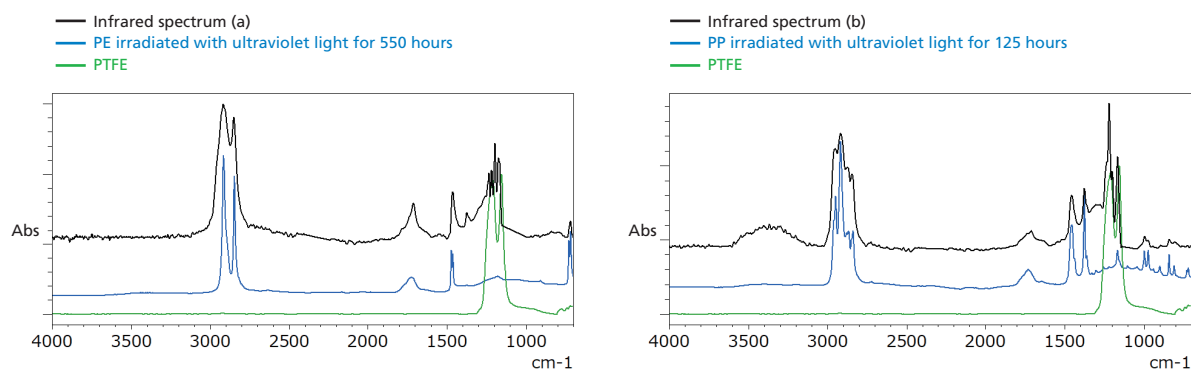
Transmission spectra and chemical image of each layer of multilayer film
(First, second, third and fourth layers from the top)

Environment

For more details,
click here.

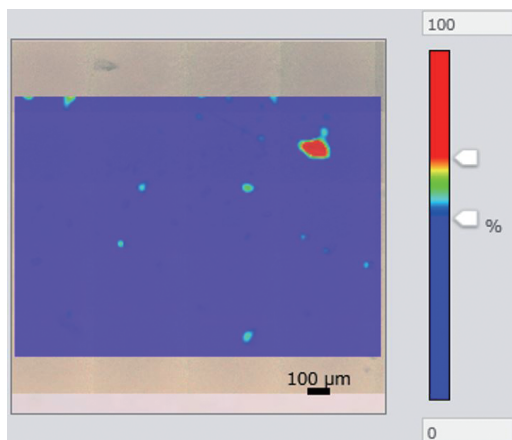
Application News No.01-00454

Shown here is an analysis of microplastics collected on polytetrafluoroethylene (PTFE) filter paper. Micro-transmission mapping analysis was performed to determine the material of the microplastics using Shimadzu's original UV-damaged plastics library. The results showed that the microplastics were polyethylene (PE) and polypropylene (PP). The absorption around $1,200\text{ cm}^{-1}$ is due to PTFE, the material used for filter paper.

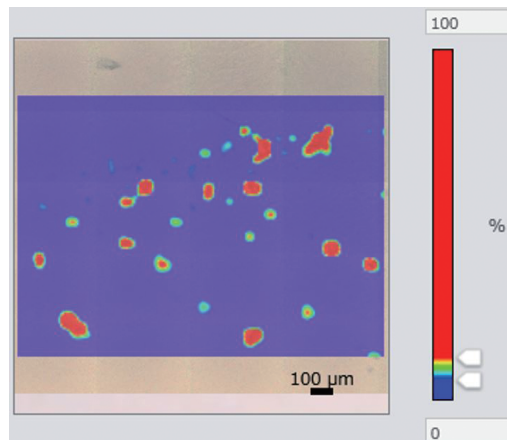


Infrared spectra (a) and (b) extracted from mapping analysis results, and search results

In addition, we performed mapping analysis of microplastics on filter paper. For the mapping data, we created chemical images based on the corrected height of the CH_2 rolling vibration mode of PE (718 cm^{-1}) and the CH_3 symmetric deflection mode of PP ($1,373\text{ cm}^{-1}$).



Chemical image of microplastics (PE) on filter paper



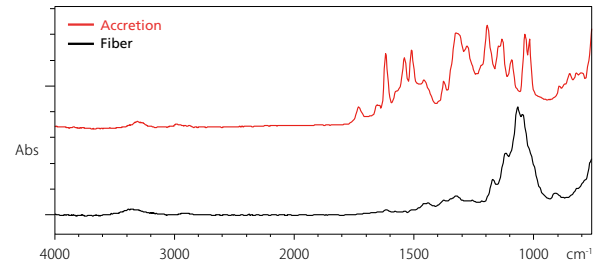
Chemical image of microplastics (PP) on filter paper

Microplastics collected on PTFE filter paper were mostly PP, and it was visually confirmed that PE was present in some of them. Finally, using the microplastic images measured in this study, we measured the length of several microplastics collected on PTFE filter paper. We found that the filter paper was dotted with multiple plastics of about 20 ~ 40 microns in size.

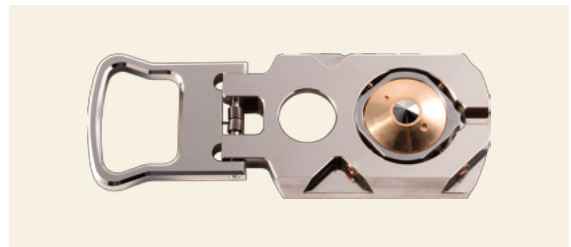
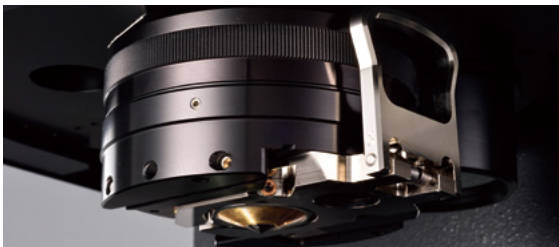


ATR Objective Mirror Ge prism:P/N 206-32600-41

The ATR objective mirror uses a cone-type prism, with single reflection, 15× magnification and a 45-degree incident angle. This slide-on type prism makes it easy to switch back and forth between visible observation and infrared measurement. This mirror 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



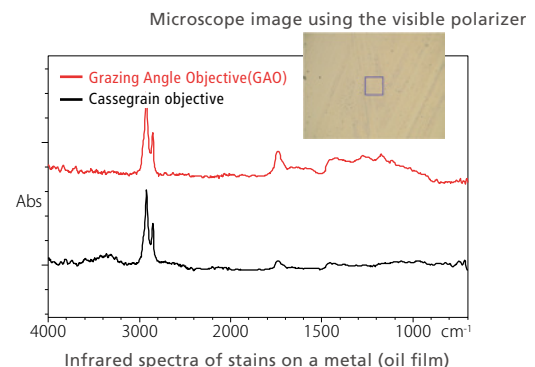
ATR Pressure Sensor P/N 206-32603-42

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



Grazing Angle Objective P/N 206-32602-41

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



TEC MCT Detector P/N 206-36820-58

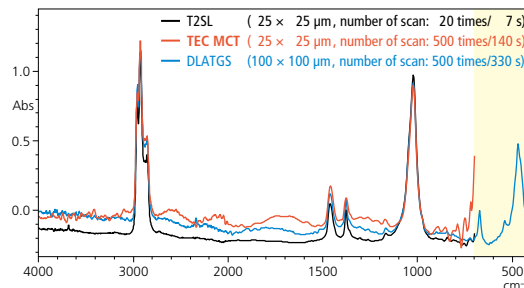
Room Temperature Detector (DLATGS) P/N 206-32580-42

Equipping the AIMSight with the TEC MCT (peltier cooled MCT) detector^{*1} or room temperature detector^{*1, *2} makes it possible to obtain infrared spectra without using liquid nitrogen. If more sensitivity is required, simply switch to the standard T2SL detector^{*3} in the software.

*1 A TEC MCT and DLATGS cannot be installed at the same time.

*2 The DLATGS can measure across a wide wave-number range. However, its sensitivity is substantially lower than the T2SL and TEC MCT.

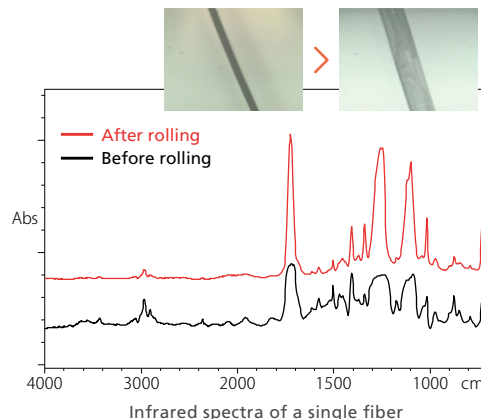
*3 Liquid nitrogen is required when using the T2SL.



Infrared spectra of polypropylene-based (containing TALC) resin for automotive bumpers using the three different detectors

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.



Infrared spectra of a single fiber

Particle Filter (PF) Holder

For 13 mm dia. (2 pc) : P/N 206-36610-41
For 25 mm dia. (2 pc) : P/N 206-36610-42

The PF holder fastens the Membrane Filter (PTFE or stainless steel (SUS)) used in microplastics analysis by gripping it. This prevents the Membrane Filter from sagging during drying, which keeps the surface flat and enables more accurate measurements.



For 13 mm dia.

Micro Vise Holder P/N 206-33293

This holder holds various types of samples for microscopy. It ensures positive holding of samples of a difficult shape or measurement of a sample at a user-selectable angle. Measurement with a polarizer, with the sample under tensile load, provides information on the molecular orientation.

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. It 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.

Data Integrity Compliance

If you don't need strict control over your data or user data, AIMSolution alone can launch software to control AIMsight and analyze your data. On the other hand, if you need to comply to regulations in the pharmaceutical market, you can use the combination of LabSolutions IR software and AIMSolution DB/CS software. Login from LabSolutions IR and acquire the data from AIMSolution. The acquired data is automatically transferred to LabSolutions IR and registered in the database. Measured data processing and analysis are executed with LabSolutions IR.

Note: You can use LabSolutions DB IR or purchase AIMSolution DB/CS in addition to LabSolutions CS IR if you are using the DB/CS edition with AIMsight.



High Security

An audit trail to ensure the reliability of data and document e-mail transmission functions when any event occurs in the system can be set up. User accounts are managed using passwords, where password length, complexity and term of validity must satisfy specified requirements. It is also possible to set lockout functions to prevent illegal access, and set a registered user's deletion and change in status. In addition, a box can be selected to prevent overwriting a data file and outputting an item to a report.

Essential Information Is Managed for Every Project

LabSolutions DB IR and CS IR provide a project management function enabling control suited to tasks and system operations. This function enables equipment and user management, security policy, and data processing to be set on a project by project basis, thereby improving the efficiency of data searches and management tasks.

Visualization of the Sequence of Analysis Operations

Report set includes test methods and test results for a series of samples analyzed as well as a corresponding operation log (a record of all operating events from login to logout), which is automatically extracted from the data and summarized in a single report. It provides visibility of the individual analytical operations, and helps to check for operating errors and improve the efficiency and reliability of checking processes.

Proven LabSolutions Software

In addition to LabSolutions IR, which provides basic functionality, Shimadzu also offers LabSolutions DB IR and LabSolutions CS IR to meet the requirements of ER/ES regulations.

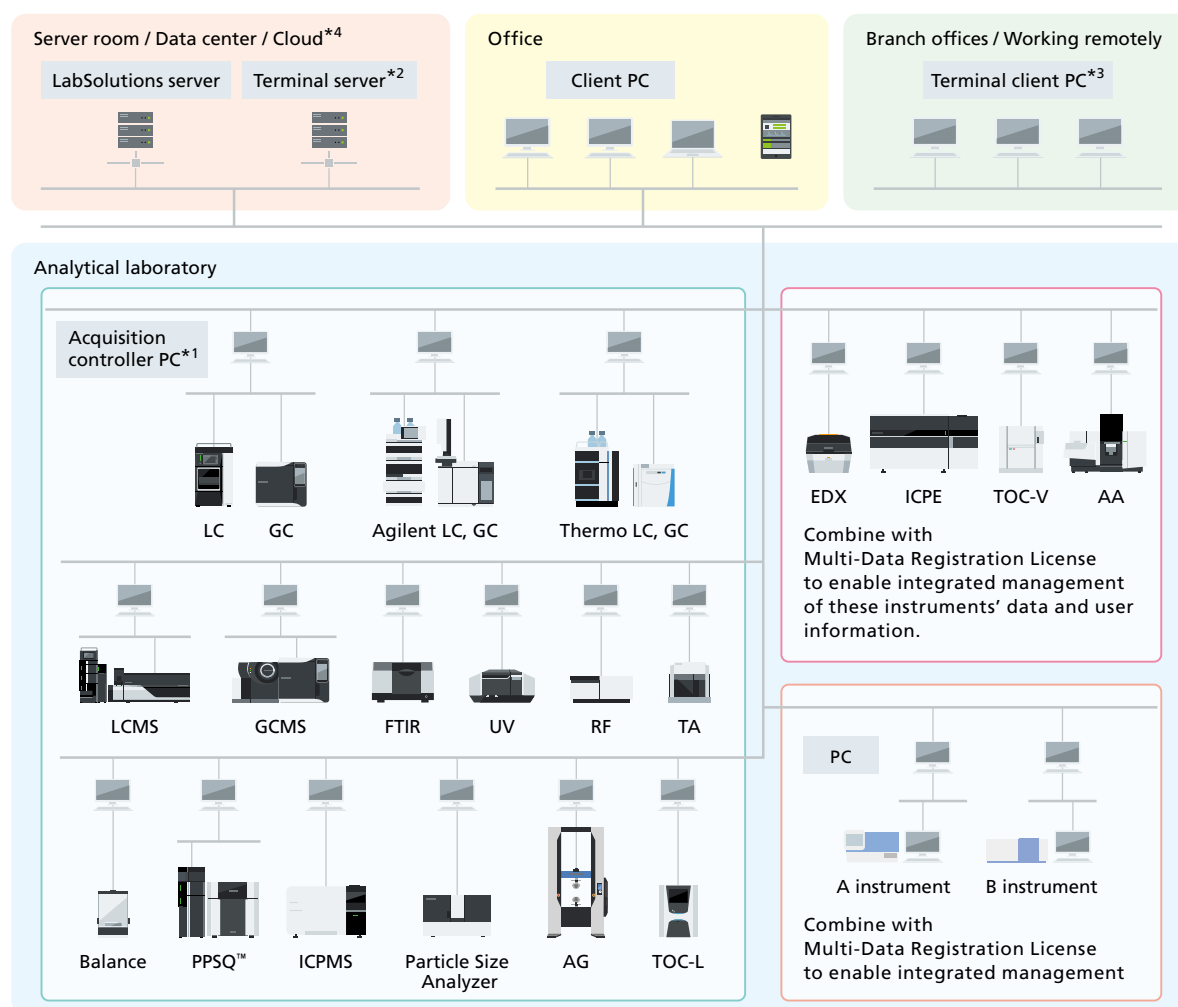
LabSolutions DB IR + AIMSsolution DB/CS

LabSolutions DB IR allows for secure data management by integrating a data management function with LabSolutions IR. Compliant with ER/ES regulations, the software is optimally configured for customers using a PC. It is recommended for facilities that do not require network connections and want to be ER/ES compliant.



LabSolutions CS IR + AIMSsolution DB/CS

Since all the data are managed on a server, LabSolutions CS IR, which is freely accessible to the analysis network, can be connected to IR and can be read from any personal computer on the network. It is recommended for facilities that have many users, manage data in a database, and want to be ER/ES compliant.



^{*1} The acquisition controller PC controls analytical instruments.

^{*2} A terminal server is a server for using terminal services. Users can view data reports and perform electronic signature operations through terminal services. It is ideal for remote connections because of the low network load. Only LC, GC, LCMS, and GCMS support analysis and post-run operations through terminal services.

^{*3} If a terminal service is used, LabSolutions software does not need to be installed on client PCs or tablets.

^{*4} Servers can be built on various clouds (IaaS). AWS (Amazon Web Services), Microsoft[®] Azure[®], GCP[™] (Google Cloud Platform[™])

System Configuration Examples



IRXross™ + AIMsight™

W1086 mm×D668 mm×H604 mm



IRTracer™-100 + AIMsight™

W1136 mm×D705 mm×H604 mm

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