

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

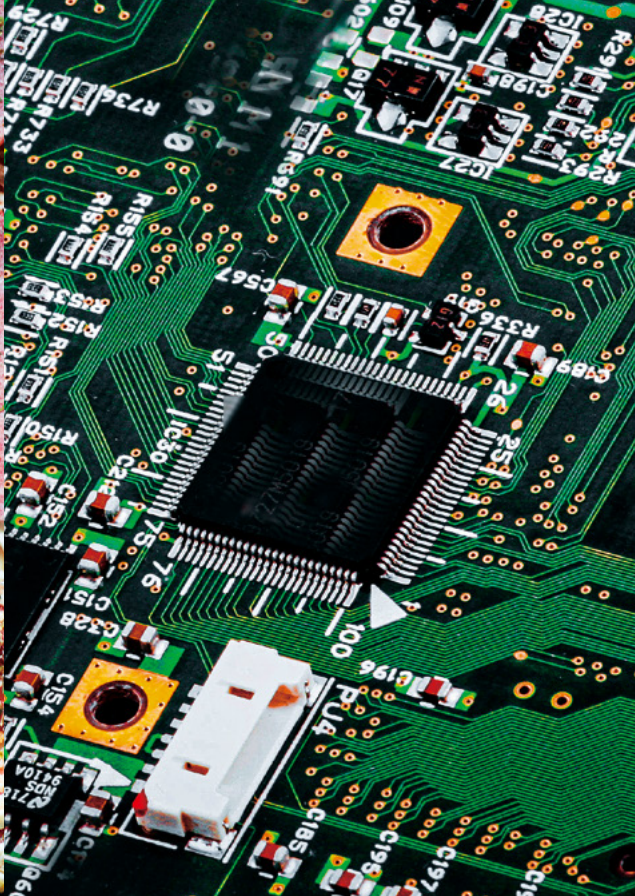
Automatic contaminant
recognition system
Highest class S/N
Length measurement function



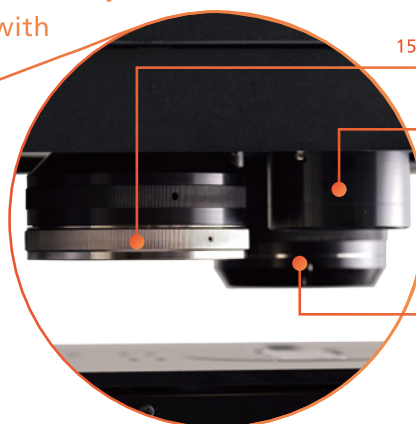
Analyze

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

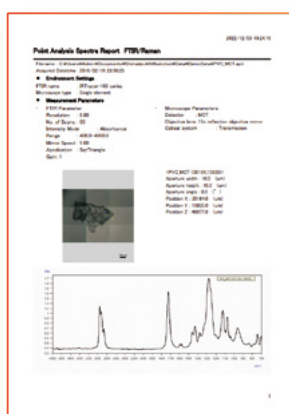
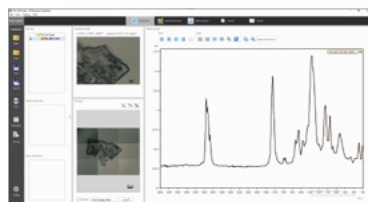


15x reflective objective mirror

Wide-field camera

Grazing Angle Objective (optional)

Exports the measurement results



Powerful support for an efficient analysis workflow

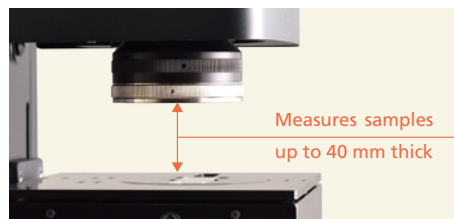


Observe

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.

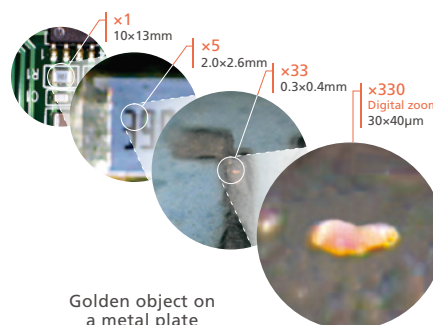


Look for the Item to be Measured

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 JP5205918). 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.

Thermally Degraded Plastics Library*1 P/N 206-33039-91 / UV-Degraded 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

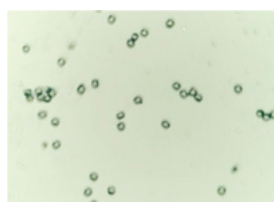
Perform Ultra Micro Analysis

- Best-in-Class S/N Ratio -

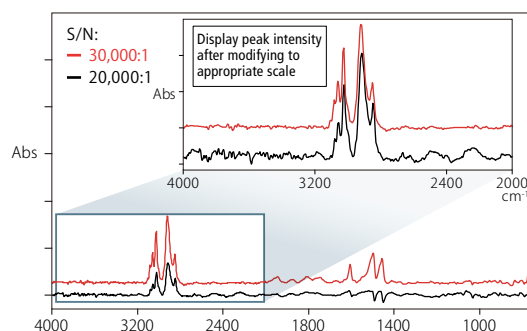
The AIMsight has been optimized to measure extremely small areas. The AIMsight achieves a 30,000:1 S/N ratio, the best in its class. Consequently, it can quickly obtain excellent spectra from even extremely small objects.

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 BaF_2 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.

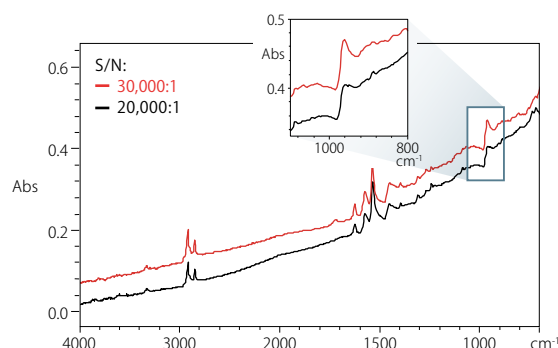
In addition, the Ge prism (P/N 206-32600-41) has an anti-reflective coating that provides high sensitivity.

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)





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

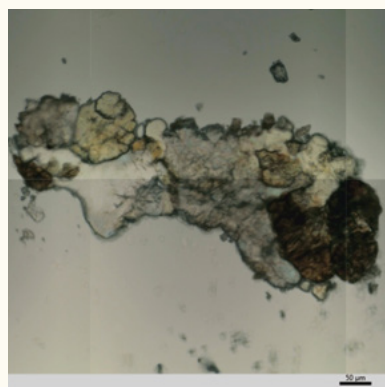
Visualize Components

- Chemical Imaging* -

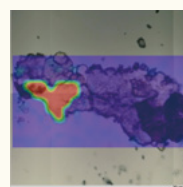
The invisible distribution of chemicals can be visualized based on peak height or area, multivariate analysis (PCR/MCR), or spectral similarity to target spectra.

Chemical image of a pharmaceutical powder

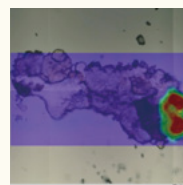
Pharmaceutical products were rolled with a diamond cell, then mapping measurement was performed. The figure to the right represents the distribution of powder components, such as lactose, lipid, and cellulose. Color display can be switched freely between single-color and multi-color.



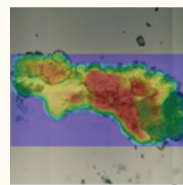
Microscopic image of pharmaceutical powder



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 an optional mapping program (P/N 206-35093-41).

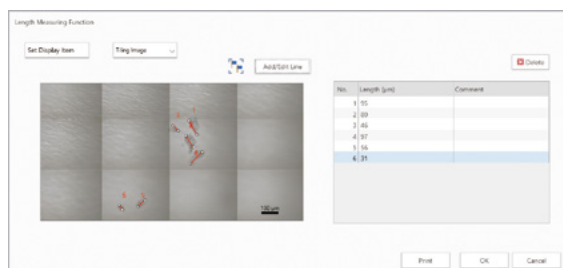


Measure

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

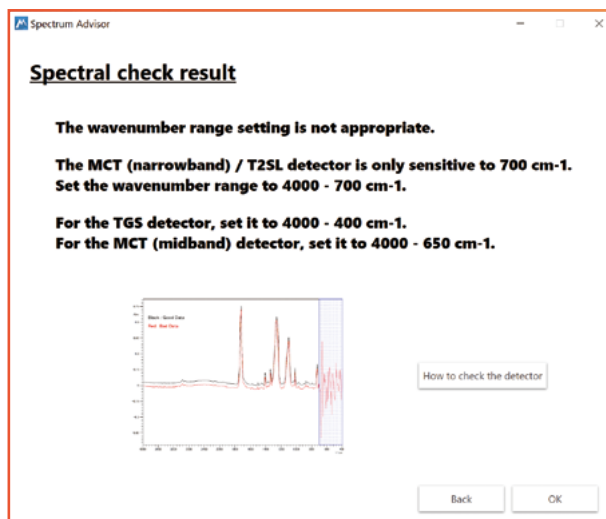
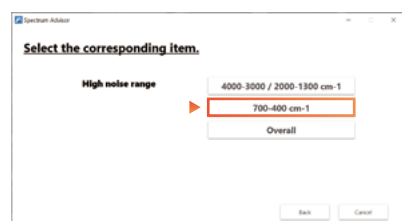
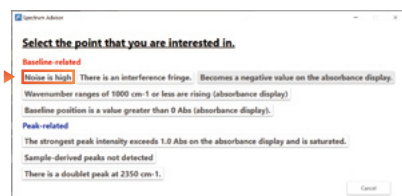
New

Spectrum Advisor Function (patent pending)



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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 Pharmacopeia (USP), the European Pharmacopoeia (EP), and Chinese Pharmacopoeia (ChP).

Items conforming to the Japanese Pharmacopoeia, US Pharmacopeia, 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 Pharmacopeia inspection item is wavenumber accuracy.



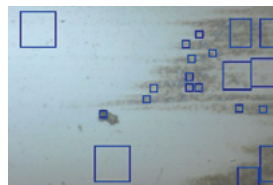
Measure



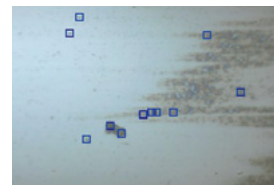
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Automatic Contaminant Recognition System

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



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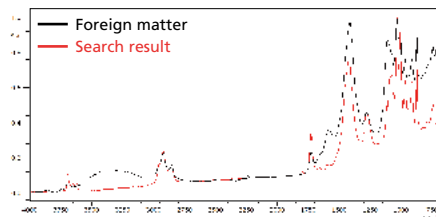
- Automated support functions utilizing digital technologies, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically 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.

Electrical and Electronic

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

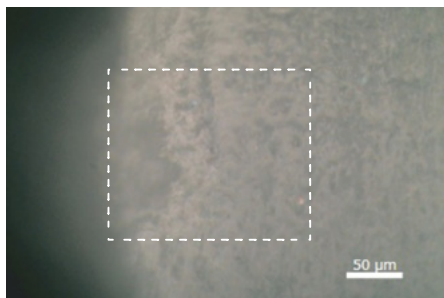


Measurement screen using length measurement function

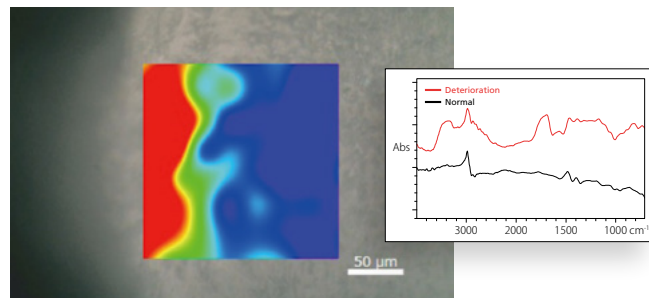
Machinery and Transportation

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

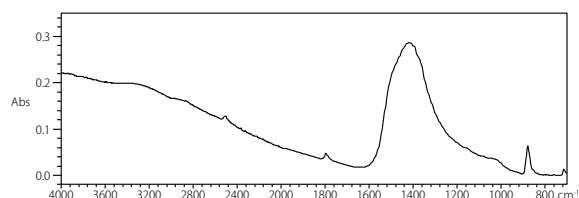
This is an examples of the analysis of foreign matter adhering to the surface of a pharmaceutical tablet. By being taken to a diamond cell and rolled, transmission measurement can be performed on various shaped samples.



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.

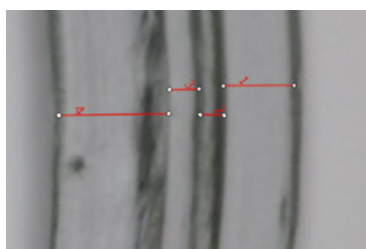


Spectrum of foreign matter collected in the diamond cell.
Identified as Carbonate

Material

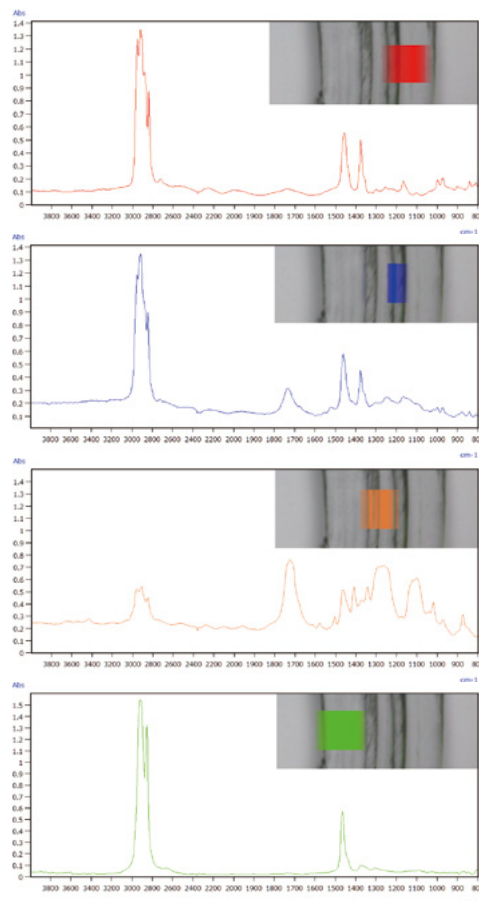
This is an analysis example of multilayer film used in potato chip packaging. Sections of the film were cut with a microtome and measured by the transmission method. We also measured the thickness of each layer using the length measurement function.

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)

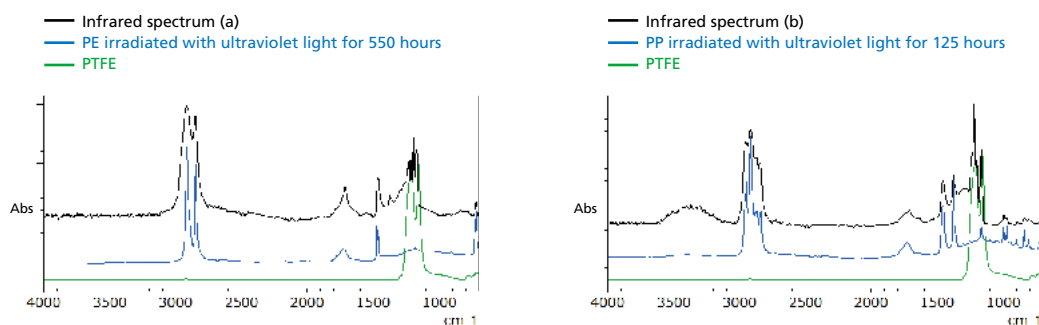
No.	Length(μm)
1	27
2	9
3	11
4	42



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

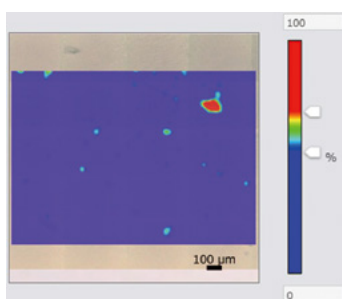
Environment

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 degraded plastic 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.

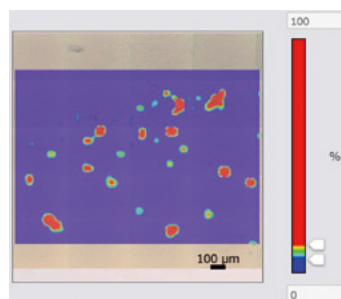


Infrared spectra (a) and (b) extracted from mapping analysis results, and search results

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 ($1,373\text{ cm}^{-1}$).

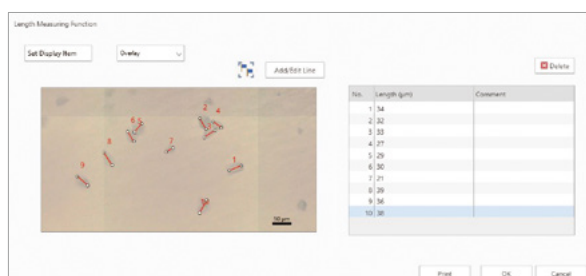


Chemical image of microplastics (PE) on filter paper



Chemical image of microplastics (PP) on filter paper

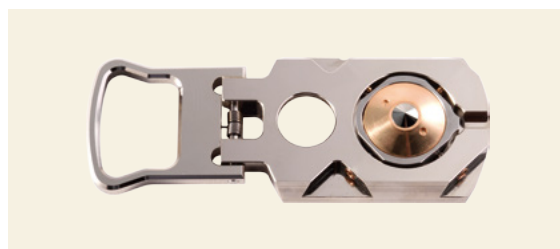
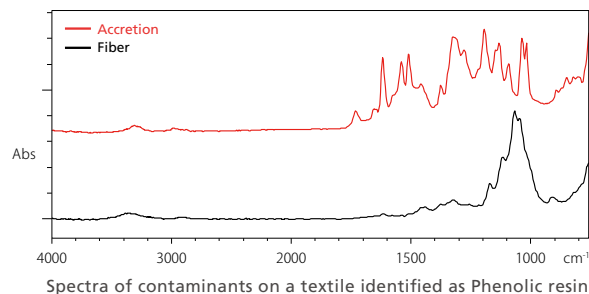
Microplastics collected on PTFE filter paper were mostly PP, and it was visually confirmed that PE was present in some of them. Finally, using the microplastic images measured in this study, we measured the length of several microplastics collected on PTFE filter paper. We found that the filter paper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



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

The ATR reflecting 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.



ATR Pressure Sensor P/N 206-32603-42

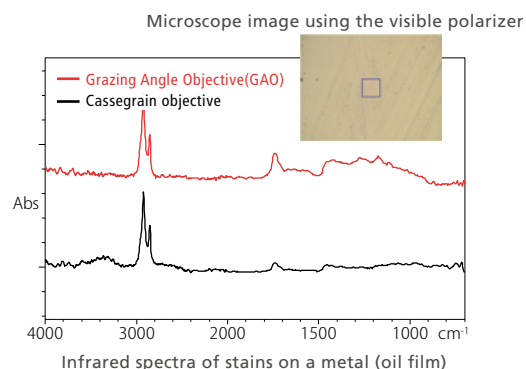
This pressure sensor prevents prism damage due to excessive pressures applied during ATR measurements using an ATR reflecting objective mirror.

It can also be used to automate ATR measurement with pressure sensing.



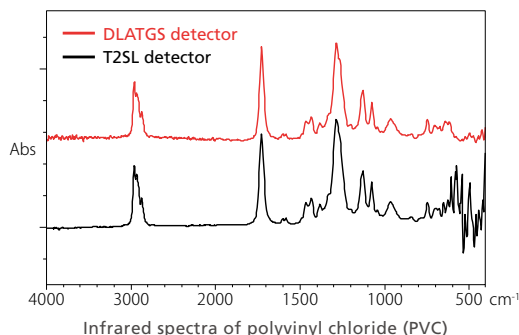
Grazing Angle Objective P/N 206-32602-41

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.



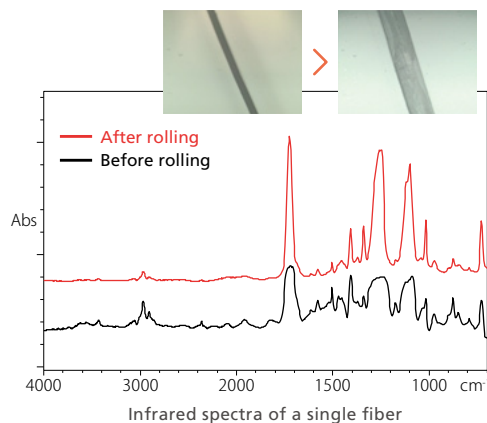
DLATGS Detector P/N 206-32580-42

By adding this DLATGS detector to an AIMsight infrared microscope, infrared spectra can be obtained without liquid nitrogen. It is also possible to switch back and forth between the T2SL and DLATGS detectors as needed. The DLATGS detector offers a wider wavenumber range (up to 400 cm^{-1}) than the T2SL detector, but with lower sensitivity. Therefore, the T2SL detector is used to measure micro samples less than $100\text{ }\mu\text{m}$.



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.



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, AMsolution 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 AMsolution DB/CS software.

Login from LabSolutions IR and acquire the data from AMsolution. 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 AMsolution DB/CS in addition to LabSolutions CS IR if you are using the DB/CS edition with AIMsight.

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.

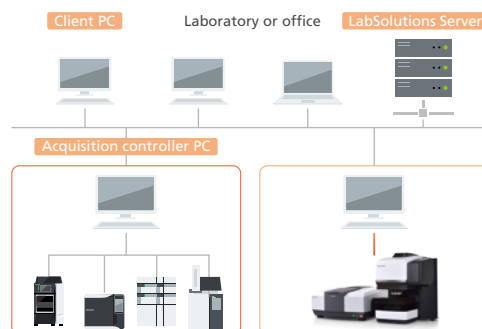
LabSolutions DB IR + AMsolution DB/CS

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 + AMsolution DB/CS

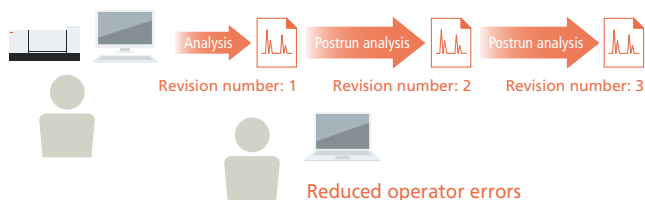
LabSolutions CS, which is freely accessible to the analysis network, can be connected to LabSolutions IR, eliminating the need for connecting a PC to the instrument. Since all the data are managed on a server, LabSolutions CS IR can be read from any personal computer on a network. With terminal service, LabSolutions IR can be controlled from a client PC without installing LabSolutions IR on it. It is recommended for facilities that have many users, manage data in a database, and want to be ER/ES compliant.



Name	LabSolutions IR	LabSolutions DB IR	LabSolutions CS IR
	AMsolution	AMsolution DB/CS	
Data management method	Measured data files are saved and managed in folders on the PC.	Measured data files are saved and managed in the LabSolutions database.	
Data references	The software references files on drives or in folders on the PC.	The software references files in the database.	
LabSolutions database	Unavailable	Available (The database resides on a local PC)	Available (The database resides on a server)
User administration	Only LabSolutions IR can be used.	Available	
Rights group administration			
Project administration			
Standalone/network	Only standalone can be used.	Only the standalone configuration can be used.	Only databases on the network can be used. (LabSolutions IR data can be viewed using the database manager on a PC set up for viewing purposes. Note that LabSolutions IR must be installed on the PC used for viewing.)
Data backup	Performed on a file-by-file basis using Windows® Explorer.	Performed for each database.	
Mapping program	Available	Unavailable	

Database Management Prevents Mistakes

With LabSolutions DB IR and CS IR, the analysis data are managed securely by the database. Overwriting, deletion and other mistakes typical of data file management do not occur. In addition, when postrun analysis is performed using the acquired data, postrun analysis data revision numbers are automatically assigned, preventing the accidental overwriting of raw data.

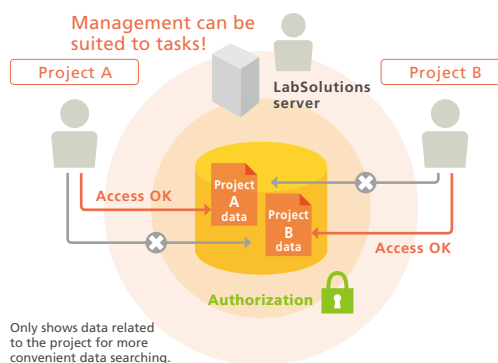


Solid Security

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 addition, a box can be selected to prevent overwriting of a data file, and outputting an item to a report can be performed.

Pertinent Information Managed for Every Project

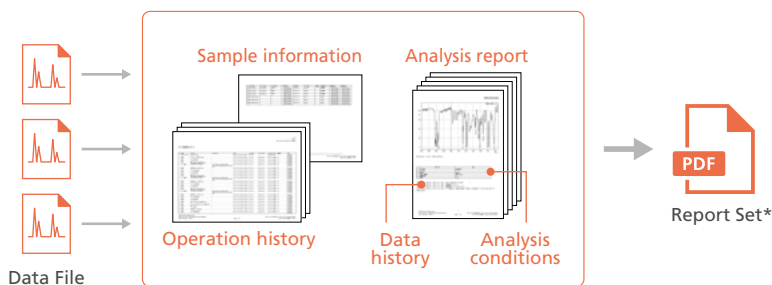
LabSolutions DB IR and CS IR provide a project management function enabling management suited to tasks and system operations. This function enables equipment and user management, security policy, and data processing to be set on a project by project basis, thereby improving the efficiency of data searches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



Visualization of the Sequence of Analysis Operations

Creating a report set* provides visibility of the individual analytical operations involved in the overall analytical process. When analytical operations are visible, it is easier to check for operating errors, which helps improve the efficiency and reliability of checking processes.

* Report sets include test methods and test results for a series of samples analyzed, and also 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.



System Configuration Examples



IRXross™ + AIMsight™

W1086 mm×D668 mm×H604 mm



IRTracer™-100 + AIMsight™

W1136 mm×D705 mm×H604 mm

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