SHIMADZU
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C103-E005N

Accessories for Fourier Transform Infrared Spectrophotometers

FTIR Series Accessories

Selection of FTIR and Optional Accessories

Compared to conventional dispersive infrared spectrophotometers, FTIR is based on a superior operating principle that offers advantages such as a Multiplex Advantage (multiplexed measurement), Aperture Advantage (solid angle), and Connes' Advantage (wavelength accuracy). Consequently, it provides a convenient way to obtain high sensitivity and high wavenumber accuracy. To fully utilize these advantages, a variety of accessories have been developed to achieve performance that was not previously possible or inadequate with conventional dispersive IR systems.

Due to the simple optics involved in FTIR systems, attachments and accessories with more complex optics are able to be used to fully demonstrate their performance. The exceptionally high wavelength accuracy enables FTIR systems to obtain complete spectra using a single-beam method, which measures reference and measurement samples separately. Since that only requires one accessory, it is more economical.

Those accessories also include various innovations to minimize the amount of sample pretreatment or machining required. In other words, the goal of FTIR analysis is to achieve completely non-destructive analysis.

The flow chart on the right side shows the process for selecting FTIR attachments and accessories. As shown in this flow chart, selecting the method for infrared analysis is essentially equivalent to selecting attachments and accessories.

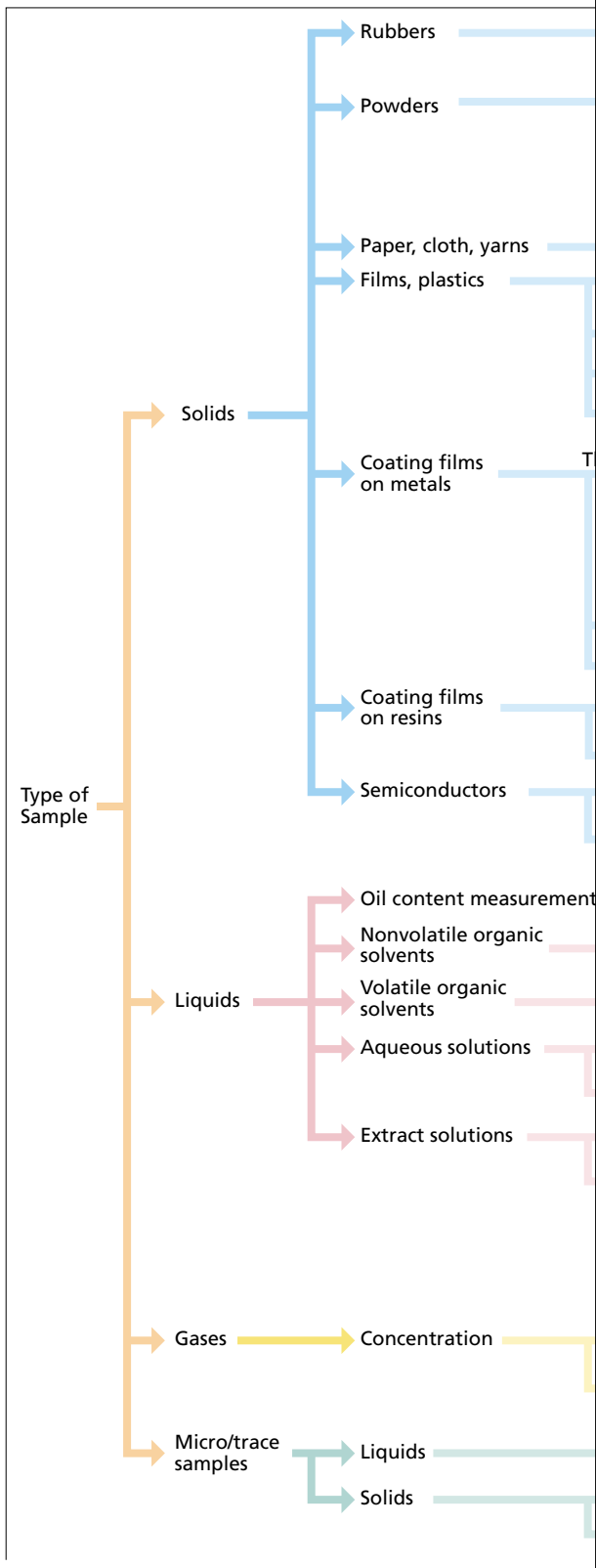
The analytical method used for infrared analysis is determined based on the physical form of the sample (such as liquid or solid). This feature of infrared analysis is completely different from for other analytical instruments such as UV-VIS spectrophotometers or gas chromatographs.

Therefore, please select the attachment or accessory that is best suited to given analytical objectives.

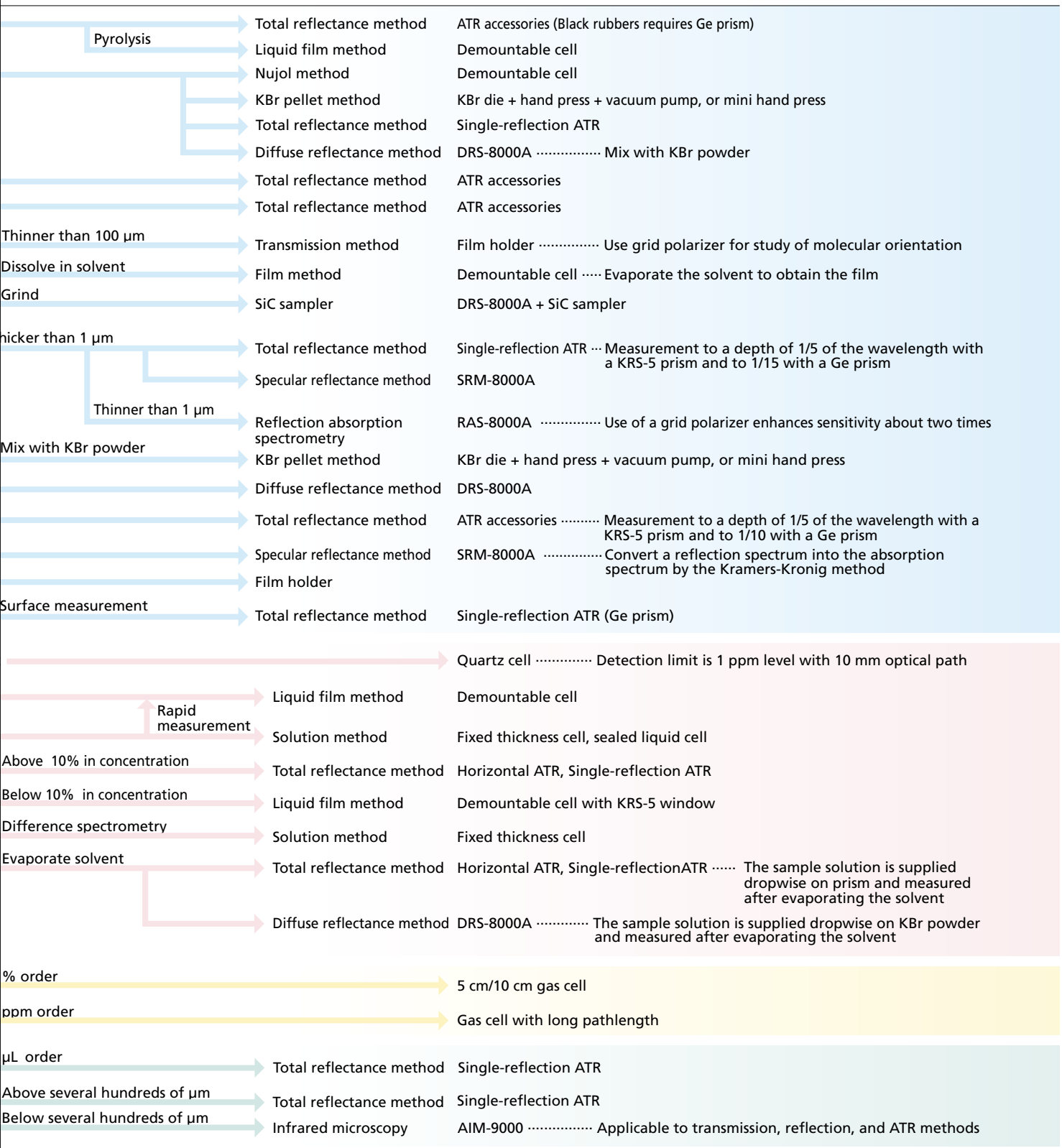
In addition, for information about specialized accessories or systems not included in this handbook, contact your Shimadzu sales representative.

Please let us know your requirements.

Flow Chart for Selecting Attachmer



nts and Accessories



Shimadzu Accessory Line-up

These attachments and accessories are ideal for the IRTracer-100, IRPrestige-21, IRAffinity-1 series, IRSpirit, or FTIR-8000 series systems, which have been developed and manufactured using state-of-the-art optical and precision machining technologies. Models are available for a variety of liquid, gas, and solid samples. Refer the following table and detailed descriptions for each accessory. For information about the options and consumables that can be used with respective accessories, see the details for each accessory.

	Description		P/N	Compatible Instrument Model					Remarks	Page
				IRTracer	IRPrestige	IRAffinity	FTIR-8000	IRSpirit		
Attenuated Total Reflectance Measurement	Single Reflection Type Attenuated Total Reflection Attachment Integral with Sample Compartment	QATR 10	227-38001-XX	✓		✓				7
		QATR-S	227-38004-XX					✓		
		MIRacle 10	206-74127-XX	✓		✓			with Diamond, ZnSe, Ge prism	8
		GladiATR 10	206-74128-XX	✓		✓			with Diamond prism	9
	Horizontal Type Attenuated Total Reflection Attachment Integral with Sample Compartment	HATR 10	206-74126-91	✓		✓			with ZnSe prism	10
	Attenuated Total Reflection Attachment	ATR-8000A	206-62303-58	✓	✓	✓			with KRS-5 prism	11
		ATR-8000	206-62303-51	✓	✓	✓	✓			
	Horizontal Type Attenuated Total Reflection Attachment	ATR-8200HA	208-97240-92	✓	✓	✓		✓	with ZnSe prism	12
		ATR-8200H	208-97240-92		✓	✓	✓	✓		
Reflectance Measurement	Specular Reflectance Attachment	SRM-8000A	206-62304-58	✓	✓	✓		✓	Incident Angle: 10°	14
		SRM-8000	206-62304-51	✓	✓	✓		✓		
	Reflection Absorption Spectrometry Attachment	RAS-8000A	206-62302-58	✓	✓	✓	✓	✓	Incident Angle: 70° to 75°	15
		RAS-8000	206-62302-51	✓	✓	✓		✓		
	Grid Polarizer	GPR-8000	206-61550-58	✓	✓	✓	✓			16
Diffuse Reflectance Measurement	Diffuse Reflectance Attachment	DRS-8000A	206-62301-58	✓	✓	✓	✓	✓		18
		DRS-8000	206-62301-51	✓	✓	✓		✓		
	SiC Sampler		200-66750-01	✓	✓	✓	✓	✓		19
	Automatic Diffuse Reflectance Attachment	DRS-8010ASC	206-62308-91	✓	✓	✓	✓			20
Micro Sample Measurement	Infrared Microscope AIM-9000	Narrow-Band MCT	206-32000-58	✓		✓	✓			22
		MID-Band MCT	206-32400-58	✓		✓				
	ATR Objective Mirror For AIM-9000		206-32600-41	Accessories for AIM-9000.					with Ge prism	23
	ATR Objective Mirror For AIM-8800	ATR-8800M	206-70450-91	Accessories for AIM-8800.					with Ge prism	
	Micro Vise Holder		206-33293	Accessories for AIM-9000.						
			208-97202	Accessories for AIM-8800.						
	ATR Pressure Sensor For AIM-9000		206-32603-41	Accessories for AIM-9000.						24
	Grazing Angle Objective For AIM-9000	GAO	206-30602-41							
	Room Temperature Detector For AIM-9000	DLATGS	206-32580-41							
	Diamond Cell C II		208-92289-01	Accessories for AIM-9000 and AIM-8800.						25
	Sampling Kit		208-92171							
	Other Microscope Options									26
	Reflection-Type Beam Condenser	RBC-8000	206-62305-58	✓	✓	✓	✓			
Accessories for Automated Measurement	Automatic Diffuse Reflectance Attachment	DRS-8010ASC	206-62708-91	✓	✓	✓	✓			28
	Auto Sampler for Transmission Measurement	ASC-8000T	206-63900-91	✓	✓	✓	✓			
	Sample Switcher 21		See text	✓	✓	✓	✓			
Purge Control Kit	Purge Control Kit	PCK-100	206-74251-41	✓						29
		PCK-21	206-72352-91		✓					
		PCK-8941	206-73512-41			✓	✓			

	Description		P/N	Compatible Instrument Model					Remarks	Page
				IRTracer	IRPrestige	IRAffinity	FTIR-8000	IRSpirit		
External Detector / Optional Detector	External light Beam Switching Kit		See text	✓	✓	✓	✓	✓		30
	MCT Kit		See text	✓	✓	✓	✓	✓		
Transmission Measurement	Cassette (Sample Holder)		206-17384	✓	✓	✓	✓	✓		31
	Magnetic-Type Film Sample Holder		200-66754-11	✓	✓	✓	✓	✓		
	Universal Clip Holder		208-97207	✓	✓	✓	✓	✓		32
	EZ-Clip 13		208-97208	✓	✓	✓	✓	✓		
	EZ-Clip 25		208-97209	✓	✓	✓	✓	✓		
	Gas Cell	5 cm Gas Cell	202-32006-XX	✓	✓	✓	✓			33
		10 cm Gas Cell	202-32007-XX	✓	✓	✓	✓			
		Long Pathlength Gas Cell	—	✓	✓	✓	✓			
Pellet Measurement	Mini Hand Press	MHP-1	200-66747-91	✓	✓	✓	✓	✓		34
	Evacuable Die for KBr Pellets		202-32010-58	✓	✓	✓	✓	✓		
	Micro Die for KBr Pellets	ø2 mm	202-32011	✓	✓	✓	✓	✓		35
		ø5 mm	202-32012	✓	✓	✓	✓	✓		
	10-ton Hydraulic Press		206-33547	✓	✓	✓	✓	✓		
	Vacuum Pump	G-20DA	206-36017	✓	✓	✓	✓	✓		
	Magnetic-Type Pellet Holder		200-66753-11	✓	✓	✓	✓	✓		36
	Agate Mortar and Pestle		200-93508	✓	✓	✓	✓	✓		
	KBr Crystal		202-34141	✓	✓	✓	✓	✓		
Cells for Liquid Samples	Demountable Cell		202-32000-XX	✓	✓	✓	✓	✓		37
	Sealed Liquid Cell		202-32001-XX	✓	✓	✓	✓	✓		
	Fixed Thickness Cell		202-32002-XX	✓	✓	✓	✓	✓		38
	Sample Cell for Oil Content Determination		See text	✓	✓	✓	✓	✓		
	Crystal Polishing Kit		202-32024	Can be used separately.						
Others	Far Infrared Kit		See text	✓	✓					39
	KRS-5 Window Set		206-74211-58	✓						
NIR Measurement	NIR Kit		See text	✓	✓					40
	Topload Type Diffuse Reflectance Attachment	UpIR A	208-97271-92	✓	✓					
	NIR Integrating Sphere	IntegratIR A	208-97272-92	✓	✓					
Optional Software	Rapid Scan		206-30200-91	✓						42
	Time Course Software		206-74558-91	✓	✓	✓	✓	✓		
	Mapping Program (AIMsolution)		206-32936-41	Accessories for AIM-9000.						
	Mapping Program		See text	Accessories for AIM-8800.						
	PLS Quantitation Program		See text	✓	✓	✓	✓	✓		43
	Curve-Fitting (Peak Splitting) Program		See text	✓	✓	✓	✓	✓		
	3D Processing Program		See text	✓	✓	✓	✓	✓		
	Macro Platform		See text	✓	✓	✓	✓	✓		44
	EDXIR-Analysis Software		206-33175-XX	✓	✓	✓	✓	✓		
Others	Sample Holder/Stocker for Contaminant Measurement EDXIR-Holder		212-25890-41	✓	✓	✓	✓	✓		

Attenuated Total Reflectance Measurement

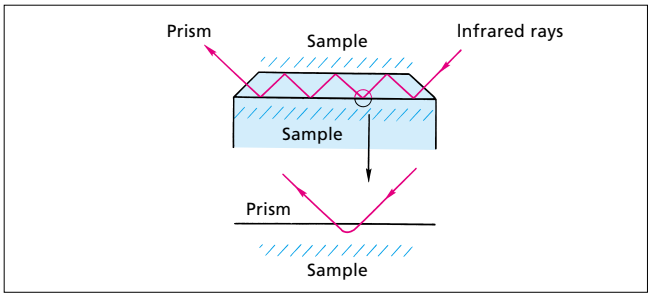
Attenuated Total Reflection Method

Of the many infrared analysis methods available, the attenuated total reflectance (ATR) method is one of the more commonly used methods. It is also frequently used for dispersive infrared spectrophotometers.
The popularity of the ATR method is due to the fact that it does not require any chemical pretreatment of samples in a variety of forms, and that it also satisfies requirements for analyzing samples without any mechanical processing. In other words, it can be used for non-destructive analysis.
Given the high sensitivity of FTIR systems, uses for the ATR method have expanded into applications that were unthinkable not long ago.

Consequently, there have been many new attachments and accessories developed for the ATR method, which continues to expand the range of samples for which it can be used.
It is also sometimes referred to as the multiple internal reflectance (MIR) method.
A wide variety of ATR attachments and accessories are available to ensure the best possible method can be selected for the given substance being measured using the IRTracer-100, IRPrestige-21, IRAffinity-1 series, IRSpirit, or FTIR-8000 series systems.

Principle

The sample is held in contact with a prism made of highly refractive material, which transmits infrared rays; infrared rays are made incident on this sample at an angle larger than the critical angle (angle that induces total reflection). The light that is totally reflected by the interface between the sample and the prism is measured to obtain an infrared spectrum.
Though it is called "total reflection", the light travels through the thin surface layer of the sample, as shown in the figure on the right, and therefore, the spectrum obtained is similar to that obtained from a very thin slice of the same sample.



Requirements for Measurements by the ATR Method

The sample must be placed in close contact with the surface of the prism.

This method is applicable to soft rubber or plastic samples, solid samples with a flat surface, liquid samples, and powder samples.

The prism has a higher refractive index than the sample.

It is necessary to use a prism having an appropriate refractive index.

Penetration Depth of IR Light (Sample thickness)

Infrared light can penetrate to a depth expressed by the next equation:

$$dp = \frac{\lambda_1}{2\pi\sqrt{(\sin^2\theta - n_{21}^2)}}$$

where, θ : Incident angle
n_{21}: (Refractive index of sample) / (Refractive index of prism)
λ_1 : Wavelength in prism
$\lambda_1 : \frac{\lambda}{n_1}$, λ : Wavelength in air, n_1 : Retractive in order of prism

Example of Penetration Depth

Sample refractive index of 1.5

Material		ZnSe/KRS-5/Diamond	
Refractive index (1,000 cm^{-1})		2.4	
Incident angle		45°	60°
Penetration depth	4,000 cm^{-1}	0.5 µm	0.28 µm
	2,000 cm^{-1}	1.0 µm	0.55 µm
	1,000 cm^{-1}	2.0 µm	1.10 µm
	400 cm^{-1}	5.0 µm	2.80 µm

Material		Germanium		
Refractive index (1,000 cm^{-1})		4		
Incident angle		30°	45°	60°
Penetration depth	4,000 cm^{-1}	0.3 µm	0.17 µm	0.13 µm
	2,000 cm^{-1}	0.6 µm	0.33 µm	0.25 µm
	1,000 cm^{-1}	1.2 µm	0.66 µm	0.51 µm
	400 cm^{-1}	3.0 µm	1.70 µm	1.30 µm

When θ= 45° and n_{21} = 0.5, therefore, 10 µm (1,000 cm^{-1}) dp corresponds to 3.18 µm and 5 µm dp (2,000 cm^{-1}) to 1.6 mm.
The ATR method provides spectra of surface layers without actually slicing them.
Since the measurable depth (thickness) differs with the wavelength of the light, the ATR method give spectra of a little different shape though the peak wavenumbers are the same.
The commercial availability of ATR libraries is evidence of this fact.

The software program for correcting for penetration depth, incorporated in the IRTracer-100, IRPrestige-21, IRAffinity-1 series, IRSpirit, FTIR-8000 series further widens the application field of the ATR method.

Single Reflection Type Attenuated Total Reflection Attachment Integral with Sample Compartment

QATR 10 (P/N 227-38001-XX) for IRTracer-100/IRAffinity-1 series
QATR-S (P/N 227-38004-XX) for IRSpirit

This is a single reflection type horizontal attenuated total reflection attachment. Samples are measured by pressing them against an approximately 1.8 mm diameter prism that is positioned horizontally. Because the prism is made only of diamond (wide-range specifications), it allows for measurements up to 400 cm^{-1}. This ATR attachment supports the measurement of liquid samples and solid samples such as plastics, fibers, films, and powders. Diamond (high-throughput specifications), Ge, and ZnSe prism plates are also available. Use the Ge prism to measure samples with a high refractive index, such as black rubber.
The clamp, which makes the prism adhere to the sample, is equipped with a built-in torque limiter. It enables reproducible pressure while minimizing the potential of damage to the prism.
Range of measurable wavenumbers:
Diamond (wide-range specifications): Up to 40 cm^{-1}*
Diamond (high-throughput specifications): Up to 400 cm^{-1}
ZnSe: Up to 500 cm^{-1}
Ge: Up to 480 cm^{-1}
Accessories are automatically recognized when installed on the main body. Note that QATR 10 is the dedicated accessory for IRTracer-100/IRAffinity-1S, and QATR-S is the dedicated accessory for IRSpirit. The IRAffinity-1 series system with an optional blue ASC connector installed cannot be used.
*: The actual wavenumber ranges that can be measured will vary depending on the specifications of the FTIR main unit. With the IRAffinity-1 series or IRTracer-100 (mid-infrared specifications), the range is up to 400 cm^{-1}


QATR10 QATR-S

IRAffnity-1S + QATR10


IRSpirit + QATR-S

Notes

- For details about the chemical resistance of the prisms, see the table at the end of this guide.

Measurable Samples

- Film
- Paper
- Rubber
- Molded plastic
- Surface coating
- Liquid and gel samples
- Powder

QATR 10 Part Names and P/N

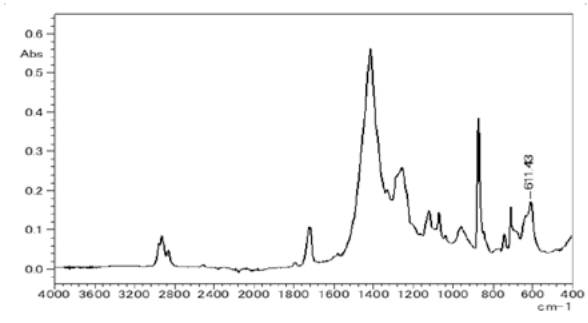
Description	P/N
QATR 10 (Wide-range specifications)	227-38001-01
QATR 10 (High-throughput specifications)	227-38001-02
QATR 10 (ZnSe disk specifications)	227-38001-03
QATR 10 (Ge disk specifications)	227-38001-04

QATR-S Part Names and P/N

Description	P/N
QATR-S (Wide-range specifications)	227-38004-01
QATR-S (High-throughput specifications)	227-38004-02
QATR-S (ZnSe disk specifications)	227-38004-03
QATR-S (Ge disk specifications)	227-38004-04

Maintenance Parts

Description	P/N
Stainless-steel flat anvil	227-38002-02
Stainless-steel pellet anvil	227-38002-03
Volatile corrosion inhibiting cover	227-38002-04
Ball driver 3.0mm (Used for removing the cover plate of optical unit)	227-38002-06
Ball driver 2.5mm (Used for adjusting the mirror of optical unit)	227-38002-07
Purge sponge set (for QATR 10)	227-38002-11
Cover plate for FTIR (for QATR 10)	227-38002-10



Infrared Spectrum of PVC Resin Piece

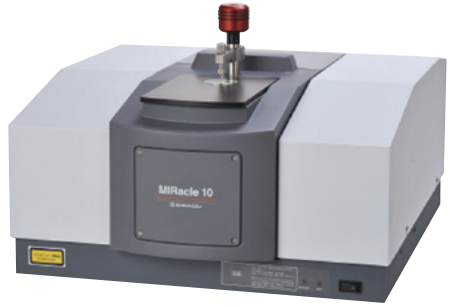
Options

Description	P/N
Diamond disk (Wide-range specifications)	227-38002-05
Diamond disk (High-throughput specifications)	227-38003-01
ZnSe disk	227-38003-02
Ge disk	227-38003-03
Specular reflection disk	227-38003-04

Single Reflection Type Attenuated Total Reflection Attachment Integral with Sample Compartment

MIRacle 10 (P/N 206-74127-XX)

This is a single reflection type horizontal attenuated total reflection attachment. Samples are measured by pressing them against an approximately 1.5 mm diameter prism that is positioned horizontally. The prism materials available are diamond (with ZnSe support element), ZnSe, and Ge.
This ATR attachment supports the measurement of liquid samples and solid samples such as plastics, fibers, films, and powders.
Use the diamond or Ge prism to measure acidic or alkaline samples. Use the Ge prism to measure samples with a high refractive index, such as black rubber.
The measurement wavenumber range is 4,600 - 600 cm^{-1} for diamond and ZnSe and 4,600 - 700 cm^{-1} for Ge.
MIRacle 10 is a dedicated accessory for IRTracer-100 and IRAffinity-1 series that incorporates an automatic accessory recognition function. It cannot be used with IRPrestige-21, IRSpirit or the FTIR-8000 series.

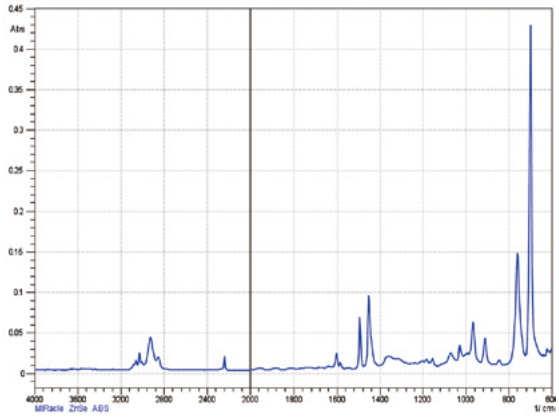


Measurable Samples

- Film
- Paper
- Rubber
- Molded plastic
- Surface coating
- Liquid and gel samples
- Powder

Notes

- Toxic hydrogen selenide may be generated if strongly acidic samples are measured using the ZnSe prism. Measure samples between pH5 and 9. Use the diamond or Ge prism to measure acidic samples to approximately pH2. Note, however, that measuring samples more acidic than this may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- For details about the chemical resistance of the prisms, see the table at the end of this guide.
- The following power supply is required if a pressure sensor is attached: 90 to 264 V AC adaptor, 0.5 VA power consumption



IR Spectrum of ABS Resin

MIRacle 10 Part Names and P/N

Description	P/N
MIRacle 10 diamond prism	206-74127-93
MIRacle 10 diamond prism with pressure sensor	206-74127-96
MIRacle 10 ZnSe prism	206-74127-91
MIRacle 10 ZnSe prism with pressure sensor	206-74127-94
MIRacle 10 Ge prism	206-74127-92
MIRacle 10 Ge prism with pressure sensor	206-74127-95

Standard Content

Description	Quantity
MIRacle 10 main unit	1
Prism plate (Select diamond, ZnSe, or Ge.)	1
Sample clamp (Select clamp with or without pressure sensor.)	1
Adaptor for liquid samples	1

Options and Maintenance Parts

Description	P/N
ZnSe prism plate for MIRacle 10	208-97320-44
Ge prism plate for MIRacle 10	208-97320-45
Diamond prism plate for MIRacle 10	208-97320-46
Pressure sensor for MIRacle 10	208-97320-62

Single Reflection Type Attenuated Total Reflection Attachment Integral with Sample Compartment

GladiATR 10 (P/N 206-74128-XX)

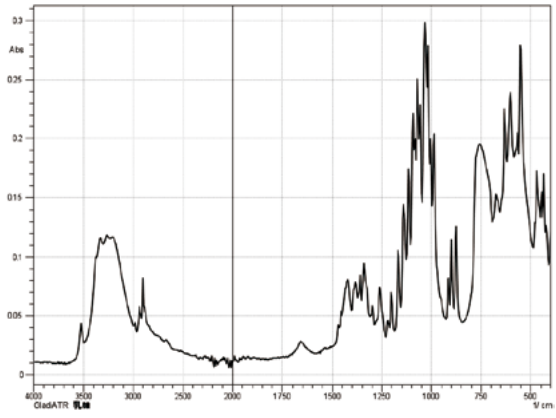
This is a single reflection type horizontal attenuated total reflection attachment. Samples are measured by pressing them against a 2.2 × 3 mm diamond prism that is positioned horizontally. An optional Ge prism is available. This ATR attachment supports the measurement of liquid samples and solid samples such as plastics, fibers, films, and powders.
Use the optional Ge prism to measure samples with a high refractive index, such as black rubber.
As the prism is made of diamond only, the measurement wavenumber range is 4,600 - 400 cm^{-1} and 4,600 - 700 cm^{-1} for the Ge prism.
GladiATR 10 is a dedicated accessory for IRTracer-100 and IRAffinity-1 series that incorporates an automatic accessory recognition function. It cannot be used with IRPrestige-21, IRSpirit or the FTIR-8000 series.

Measurable Samples

- Film
- Paper
- Rubber
- Molded plastic
- Surface coating
- Liquid and gel samples
- Powder

Notes

- Measuring strongly acidic samples below pH3 may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- For details about the chemical resistance of the prisms, see the table at the end of this guide.
- The following power supply is required if a pressure sensor is attached: 90 to 264 V AC adaptor, 0.5 VA power consumption



IR Spectrum of Lactose Powder

GladiATR 10 Part Names and P/N

Description	P/N
GladiATR 10 diamond prism	206-74128-91
GladiATR 10 diamond prism with pressure sensor	206-74128-92

Standard Content

Description	Quantity
GladiATR 10 main unit	1
Diamond prism plate	1
Sample clamp (Select clamp with or without pressure sensor.)	1
Adaptor for liquid samples	1

Options and Maintenance Parts

Description	P/N
Ge prism plate for GladiATR 10	208-97321-44
Diamond prism plate for GladiATR 10	208-97321-42
Pressure sensor for GladiATR 10	208-97321-62

Horizontal Type Attenuated Total Reflection Attachment Integral with Sample Compartment

HATR 10 (P/N 206-74126-91)

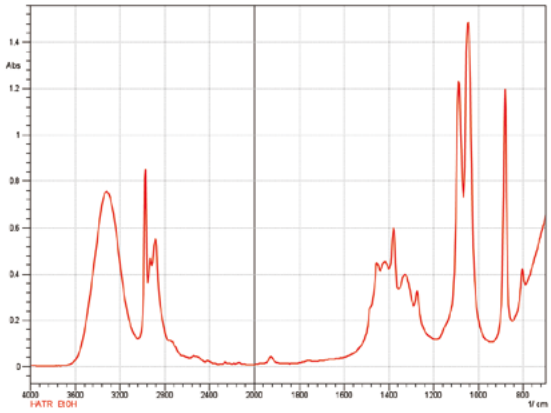
Samples are measured by pressing them against a prism that is positioned horizontally. The prism is made of ZnSe, and an optional Ge prism is also available. This ATR attachment supports the measurement of liquid samples and flat solid samples such as films, rubbers, and flat plastics. It is not suitable for powder samples or very small samples.
Use the optional Ge prism to measure samples with a high refractive index, such as black rubber.
HATR 10 is a dedicated accessory for IRTracer-100 and IRAffinity-1 series that incorporates an automatic accessory recognition function. It can not be used with IRPrestige-21, IRSpirit or the FTIR-8000 series.

Features

- Two separate prisms for solid and liquid samples are supplied as standard.
- The prism is easy to install and remove, making cleaning and replacement of the prism simple.
- The measurement wavenumber range is 4,600 - 700 cm^{-1} for the ZnSe prism. It supports the measurement of liquid samples between pH5 and 9.
- The measurement wavenumber range is 4,600 - 700 cm^{-1} for the Ge prism. It supports the measurement of samples with a high refractive index and acidic or alkaline samples. Note, however, that measuring strongly acidic samples below pH3 may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- Number of reflections: 10
- Prism dimensions: 80 mm × 10 mm
- For details about the chemical resistance of the prisms, see the table at the end of this guide.

Measurable Samples

- Film
- Paper
- Rubber
- Flat plastic
- Surface coating on flat metal
- Liquid and gel samples



IR Spectrum of Ethanol

Notes

- Toxic hydrogen selenide may be generated if strongly acidic samples are measured using the ZnSe prism. Measure samples between pH5 and 9. Use the Ge prism to measure acidic samples to approximately pH2. Note, however, that measuring samples more acidic than this may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- For details about the chemical resistance of the prisms, see the table at the end of this guide.

Standard Content

Description	Quantity
HATR 10 main unit	1
ZnSe prism for solid samples, 45° incident angle	1
ZnSe prism for liquid samples, 45° incident angle	1
Sample clamp	1

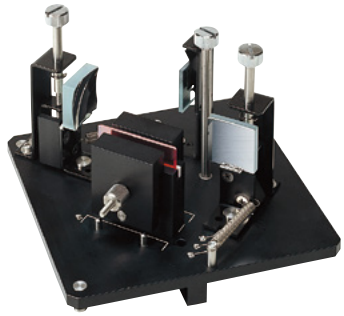
Options and Maintenance Parts

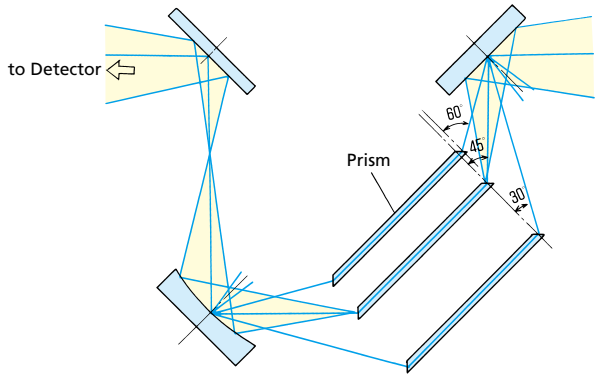
Description	P/N
ZnSe prism plate for solid samples, 45° incident angle, for HATR 10	208-97319-44
Ge prism plate for solid samples, 45° incident angle, for HATR 10	208-97319-48
ZnSe prism plate for liquid samples, 45° incident angle, for HATR 10	208-97319-43
Ge prism plate for liquid samples, 45° incident angle, for HATR 10	208-97319-47

Attenuated Total Reflection Attachment

ATR-8000A (P/N 206-62303-58)
ATR-8000 (P/N 206-62303-51)

In the ATR-8000 series, the incident angle is changeable in three steps of 30°, 45°, and 60°, so that measurement can be made to different depths. Combined with the program to correct for the penetrating depth of the infrared rays (which is a weak point of the ATR method because it differs depending on the wavenumber), this feature provides spectra that are highly comparable to those given by another method.
A KRS-5 prism is provided standard. An optional Ge prism is used to measure samples with a high refractive index.
ATR-8000A includes the automatic accessory recognition function.





Optics of ATR-8000

Features

- It is not necessary to adjust the position of the prism when a new sample is set.
- The sample holder is held at one point; hence, the prism is under minimized force.
- 25 times reflection (with an incident angle of 45°) ensures high sensitivity.
- Maximum sample size: 40 mm × 15 mm, 10 mm thick
- The measurement wavenumber range is 4,600 - 400 cm^{-1} for the KRS-5 prism.
- The measurement wavenumber range is 4,600 - 700 cm^{-1} for the Ge prism. It supports the measurement of samples with a high refractive index and strongly acidic or alkaline samples. Note, however, that measuring strongly acidic samples below pH3 may result in corrosion of the prism or prism holder. Consult your Shimadzu representative.
- For details about the chemical resistance of the prisms, see the table at the end of this guide.

Measurable Samples

- Film
- Paper
- Rubber
- Flat plastic
- Surface coating on flat metal

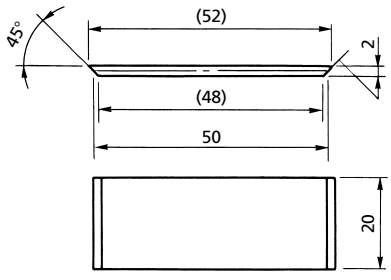
Standard Content

Description	Quantity
Attenuated Total Reflection Attachment main unit	1
ATR prism (KRS-5)	1
Sample holder	1 set
Hex key wrench	1
Phillips screwdriver	1

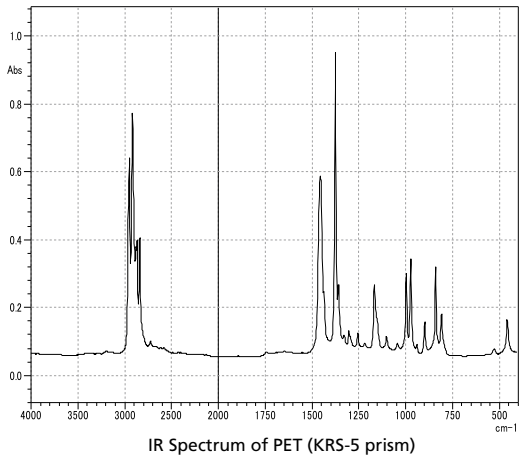
Options and Maintenance Parts

Material	With holder (P/N)	Without holder (P/N)
KRS-5	206-61560-01	200-66125-01
Ge	206-61560-02	200-66125-02

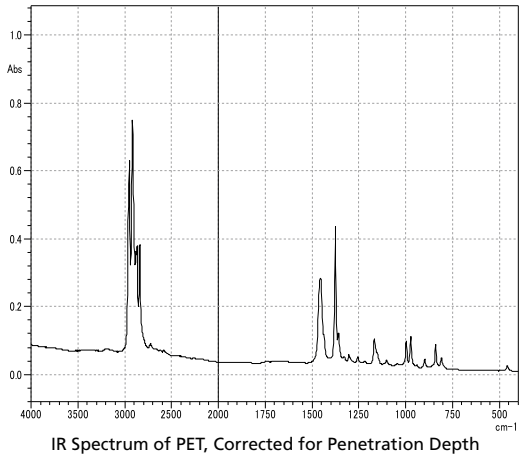
Note: Prisms without a holder are recommended as supplies, while those with a holder are recommended when prisms of different materials are purchased.



Dimensions of Prism (mm)



IR Spectrum of PET (KRS-5 prism)



IR Spectrum of PET, Corrected for Penetration Depth

Horizontal Type Attenuated Total Reflection Attachment

ATR-8200HA (P/N 208-97240-92)
ATR-8200H (P/N 208-97240-92 except IRTracer-100)

The principle is the same as the ATR-8000. Since the prism can be placed horizontally, liquid or gel samples, which cannot be analyzed with the ordinary ATR-8000/8000A can be readily measured.
ZnSe prisms are provided standard. An optional Ge prism is used to measure samples with a high refractive index or highly acidic or alkaline samples.
ATR-8200HA includes the automatic accessory recognition function.

Features

- Prisms for liquid samples and for solid samples are provided as standard.
- The prism is mounted and dismounted by one-touch operation, which ensures easy exchange of samples and cleaning of prism.
- The measurement wavenumber range is 4,600 - 700 cm^{-1} for the ZnSe prism. It supports the measurement of samples between pH5 and 9.
- The measurement wavenumber range is 4,600 - 700 cm^{-1} for the Ge prism. It supports the measurement of samples with a high refractive index and strongly acidic or alkaline samples. Note, however, that measuring strongly acidic samples below pH3 may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- Number of reflections: 10
- Prism dimensions: 80 mm × 10 mm
- For details about the chemical resistance of the prisms, see the table at the end of this guide.

Measurable Samples

- Film
- Paper
- Rubber
- Flat plastic
- Surface coating on flat metal
- Liquid and gel samples

Notes

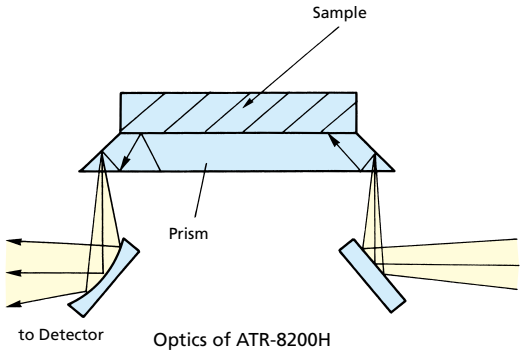
- Toxic hydrogen selenide may be generated if strongly acidic samples are measured using the ZnSe prism. Measure samples between pH5 and 9.
- Use the Ge prism to measure acidic samples to approximately pH2. Note, however, that measuring samples more acidic than this may result in corrosion of the prism or prism plate. Consult your Shimadzu representative.
- For details about the chemical resistance of the prisms, see the table at the end of this guide.
- When ATR-8200HA (P/N 208-97240-92) is used on IRTracer-100, the Purge tube (P/N 208-97240-36) is required.

Standard Content

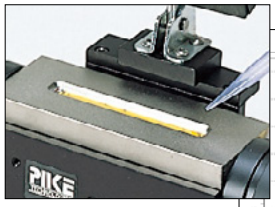
Description	Quantity
Horizontal Type Attenuated Total Reflection Attachment main unit	1
ZnSe prism for solid samples, 45° incident angle	1
ZnSe prism for liquid samples, 45° incident angle	1
Gripper (P/N 208-97240-25)	1

Maintenance Parts

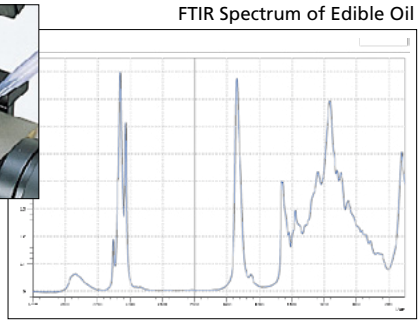
Description	P/N
ZnSe prism for solid samples, 45° incident angle	208-97240-03
ZnSe prism for liquid samples, 45° incident angle	208-97240-01
Ge prism for solid samples, 45° incident angle	208-97240-13
Ge prism for liquid samples, 45° incident angle	208-97240-10
Purge tube for IRTracer-100	208-97240-36



Optics of ATR-8200H



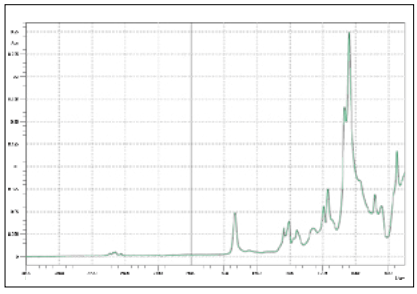
FTIR Spectrum of Edible Oil



Spectrum of Edible Oil

The prism for liquid samples is fixed in the bottom of a boat-shaped groove, as shown in the above figure, so that liquid, powder or gel samples can be easily measured.
The indentation to accept the sample is accessible from above to ensure ease when replacing samples and cleaning the prism.

FTIR Spectrum of PVDC Sheet



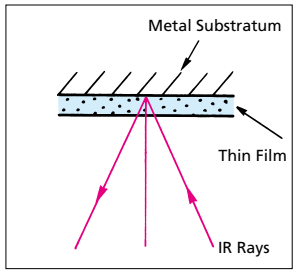
The prism for solid samples permits easy measurement of film and other solid samples, with operation being the same as that for the regular ATR.
A gripper is fixed to hold the sample in close contact with the prism surface, which enables highly reliable spectra.

Reflectance Measurement

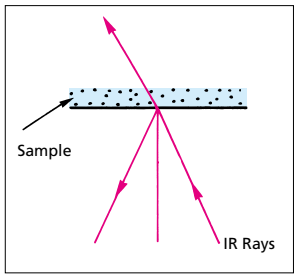
Specular Reflectance Method

FTIR measurement by the specular reflectance method provides three types of information shown below:

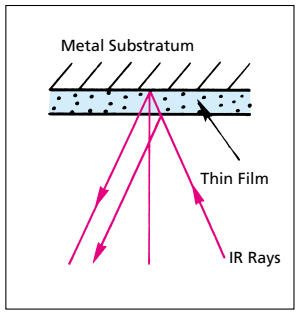
①The incident light passes through the sample layer and is reflected by the substrate: the spectrum given is similar to that obtained by the transmission method. Measurement of thin film on a metal plate is a typical example of this method.



②The incident light is reflected by the surface of the sample: the reflection spectrum is obtained, which can be converted into absorption spectrum through the use of the Kramers-Kronig analysis method. Transmitted light cannot be detected.



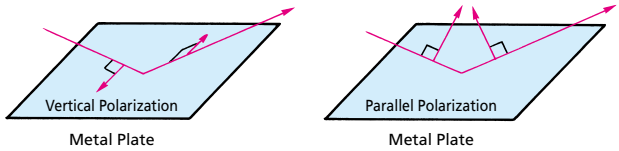
③The above mentioned two types of information are mixed: the spectrum given is the sum of the transmission spectrum and the reflection spectrum. When the sample has a uniform thickness, the two reflection light beams interfere with each other, and the sample thickness can be obtained from the interference pattern. The measurement of a epitaxial layer of a semi-conductor sample is a typical application of this method.



1.Reflection Absorption Spectroscopy

The Reflection Absorption Spectroscopy (RAS) method permits high-sensitivity measurement of a thin film sample on a metal substrate. This method has recently come to be applied to the measurement of very thin (a few tens of angstroms thick) samples and to the determination of molecular orientation.

When a polarized light beam is made incident on a metal substrate, as shown below, it is changed in phase when reflected by the metal surface.



Reflection of Light on Metal Substratum

1. In vertical polarization, the vectors of the polarized light are opposite to each other. Therefore, no stationary waves are produced on the substrate, and interaction with the film material is not detected.
2. In parallel polarization, the vectors of the polarized light meet at a point to produce stationary waves, which interact with the film and are absorbed. The intensity of this absorption is dependent on the incident angle: the larger the incident angle, the higher the intensity of absorption. The optimum incident angle is different with the type of sample and the wavelength of the peak under study. In many cases, an incident angle between 70° and 80° is used.

2.Conversion of Reflection Spectra into Absorption Spectra

A reflection spectrum, which provides information on the optical properties of the sample, must be converted into the absorption spectrum to be informative about the chemical structure of the sample. The Kramers-Kronig analysis method is quite convenient in that it is useful to convert a reflection spectrum into an absorption spectrum: it is not necessary to shave or slice the sample. In the example (2) shown on the left, when the ø is sufficiently small, each element of the complex refractive index of a material may be expressed as:

Reflectance value $$n=\frac{1-R}{1+R-2\sqrt{R}\cos\theta} \quad \text{-------} (1)$$

Absorption coefficient $$k=\frac{-2\sqrt{R}\sin\theta}{1+R-2\sqrt{R}\cos\theta} \quad \text{-------} (2)$$

where, R: Reflectance value

θ: phase shift when the light is reflected.

The θ for the wavenumber vg may be calculated from the following Kramers-Kronig equation:

$$\theta(\nu g)=\frac{2\nu g}{\pi}\int_0^\infty -\frac{\ln\sqrt{R}(\nu)}{\nu^2-\nu g^2}\,d\nu \quad \text{-------} (3)$$

The θ can be obtained from the reflectance value R, and substituting that θ in the equation (2) gives the absorption coefficient k. Performing this calculation for all the wavenumbers will give the absorption spectrum.

Examples of Applications

Since a reflection spectrum can be converted into the absorption spectrum through Kramers-Kronig analysis,

① Absorption spectrum can be obtained without shaving or slicing the sample, provided that the sample has a smooth surface. It is not necessary to use an ATR prism or a costly attachment.

② Kramers-Kronig analysis method is especially effective for infrared microscopy, where it is virtually impossible to slice the sample.

Specular Reflectance Attachment

SRM-8000A (P/N 206-62304-58)
SRM-8000 (P/N 206-62304-51)

The specular reflectance measurement method is an old method to obtain reflection IR spectra.
The SRM-8000 series permits not only measurement of reflection spectra, but also measurement of absorption spectra through the combined use of the Kramers-Kronig analysis method.
This attachment provides absorption spectra of solids, such as high polymers, without using a prism, which is required in the ATR method.
QuickStart SRM-8000A includes the automatic accessory recognition function.

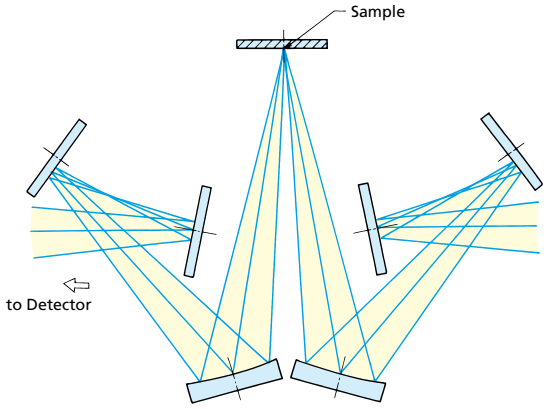
Features

- Easy sample setting.
- Kramers-Kronig conversion software provides IR spectra without sample preparation.
- The incident angle is 10° on average.

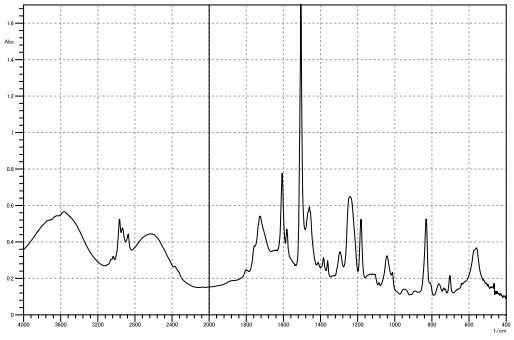
Measurable Samples

- Coatings on flat metal surfaces with µm order.
- Flat plastic sheet.

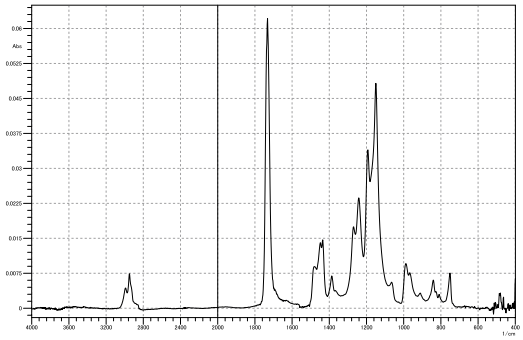
Description	P/N	Quantity
Specular reflectance attachment main unit		1
Standard mirror	200-66123	1
Sample mask, 15 mm dia.	206-18752-02	1
Hex key wrench		1
Phillips screwdriver		1



Optics of SRM-8000



Specular Reflectance Spectrum of the Inner Wall of Aluminum Can

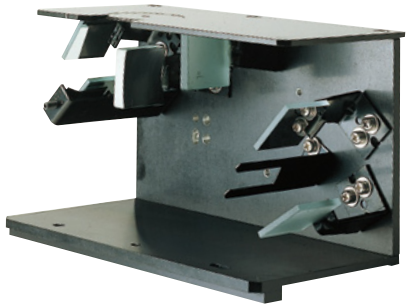


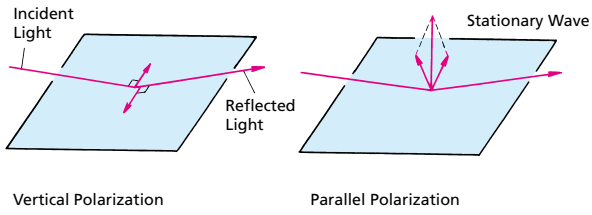
Specular Reflectance Spectrum of PMMA after Kramers-Kronig Conversion

Reflection Absorption Spectrometry Attachment

RAS-8000A (P/N 206-62302-58)
RAS-8000 (P/N 206-62302-51)

The reflection absorption spectrometry method is used only in FTIR. When a vertically polarized light and a horizontally polarized light are made incident on a metal substrate, the lights are changed in the respective phase. In the case of vertically polarized light, the phase change is about π, irrespective of the incident angle, and, hence, the vectors of the reflected light interact destructively with each other; the stationary waves produced have almost zero amplitude - no absorption of the sample is detected. In the case of horizontally polarized light, the amount of phase change varies continuously from zero (for 0° incident angle) to π (for 90°). The amplitude of the stationary waves produced also changes with the incident angle: when a high incident angle is selected, the stationary waves will have a high amplitude and the interaction of the light beam and the sample will be high, resulting in a high detecting sensitivity. This method permits high-sensitivity measurement of thin films on metals having a high reflectance. Combined use of a grid polarizer further enhances the sensitivity. A grid polarizer (P/N 206-61550-58) is not included in the standard content of the RAS-8000 series but is available as an option. QuickStart RAS-8000A includes the automatic accessory recognition function.





Principle of Reflection Absorption Spectrometry

Features

- Easy sample setting.
- The incident angle is selectable between 70° and 75°.

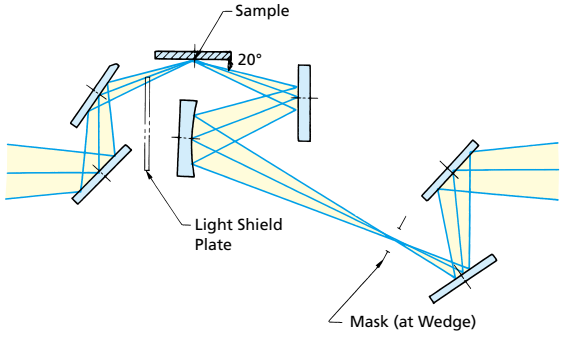
Measurable Samples

- Coatings on flat metal surfaces with a thickness in the nanometer range
- Flat plastic sheet

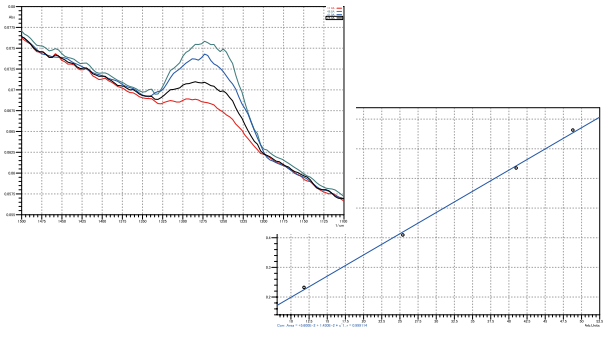
Standard Content

Description	P/N	Quantity
Reflection absorption spectrometry attachment		1
Standard mirror	200-66123	1
Sample mask, 8 mm dia.	206-18752-01	1
Sample mask, 15 mm dia.	206-18752-02	1
Sample mask, 25 mm dia.	206-18752-03	1
Light beam mask, 3 × 3 mm	206-18608-01	1
Light beam mask, 5 × 5 mm	206-18608-02	1
Light shielding plate*		1
Hex key wrench		1
Phillips screwdriver		1

* Attaching the light shielding plate raises the mean incident angle of the light beam from 70° to 75°.



Optics of RAS-8000



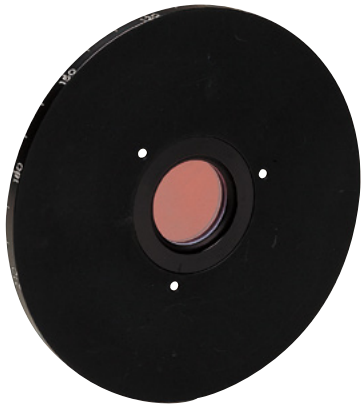
Relationship between Spectrum of Fluorine Film on Hard Disk, Peak Area and Film Thickness (Calibration Curve)

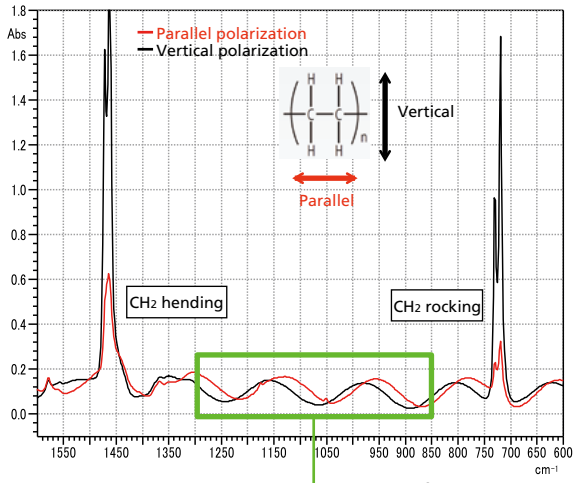
Grid Polarizer

GPR-8000 (P/N 206-61550-58)

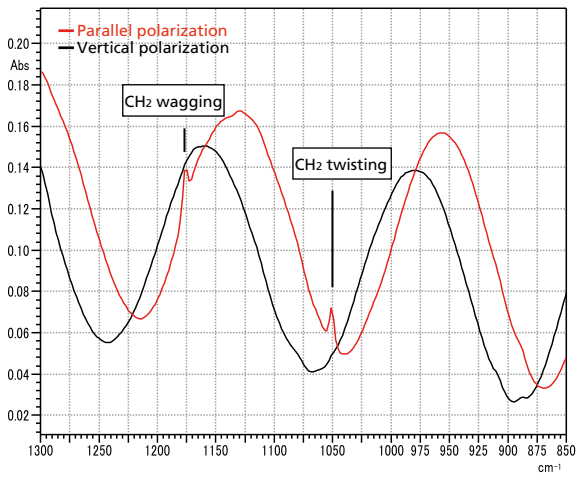
A grid is precisely produced on the substrate by the photographic technique. The grid polarizer enhances the sensitivity of the RAS-8000 Reflection Absorption Spectroscopy Attachment.

Degree of polarization:	99% (at 10 µm), 95% (at 3 µm)
Quenching ratio:	148:1 (at 10 µm), 23:1 (at 3 µm)
Effective area:	25 mm dia.
Angle scale:	360°, 10° increments
Material of substrate:	KRS-5, 2 mm thick
Measurement wavenumber range:	5,000 to 350 cm^{-1}





Spectrum of Elongated Polyethylene Film

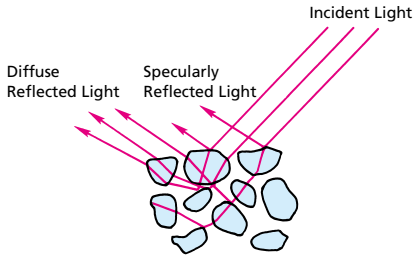


Spectrum of Elongated Polyethylene Film (Enlarged)

Diffuse Reflectance Measurement

Diffuse Reflectance Spectroscopy

In measurement of powder samples by the dispersive IR method, the KBr pellet method is often used. The powder sample is mixed with alkali halide powder, such as KBr, and briquetted into a pellet, which is then measured by the transmission method. This KBr pellet method is also used in FTIR, but the diffuse reflection spectroscopic method is easier to perform.
As shown in the figure below, when a light beam is made incident on a powder sample, some part of the light is specularly reflected by the surface of the powder. The other part penetrates into the sample and is transmitted and reflected repeatedly, and then emerges out of the sample as a diffuse reflected (scattered) light. This diffuse reflected light is informative of the IR spectrum of the powder sample.



Reflection within Powder Sample

Diffuse reflected light, which has been repeatedly transmitted within the powder sample, gives a spectrum similar to ordinary transmission spectrum. The spectral intensity is not completely proportional to the concentration of the compounds under study: those components which are detected as rather low intensity absorption bands are detected at higher intensity because the light beam is transmitted repeatedly in the sample. It is necessary, therefore, to compare diffuse reflected spectra with ordinary transmission spectra or to convert them with the Kubelka-Munk equation.

$$f = (1-R)^2/2R = K/S$$

where, K: absorption coefficient
S: scattering coefficient
R: reflection index
(sample power spectrum/dilution power spectrum)

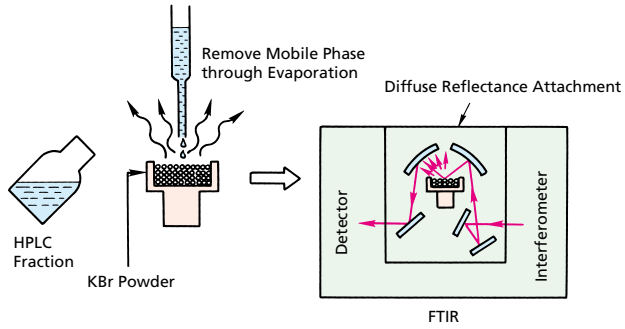
Since it is very difficult to measure absolute reflection indices, diffuse reflection indices, which are the values relative to the reflection of KBr or KCl powder having no absorption in the IR region, are generally used.
The spectra thus obtained are Kubelka-Munk converted to have intensities proportional to concentration. The result is spectra useful for quantitative determination. IRTracer-100, IRPrestige-21, IRAffinity-1 series, IRSpirit and FTIR-8000 series incorporates the Kubelka-Munk conversion function as a standard feature.

Application 1

The diffuse reflectance spectroscopic method is applicable to any sample that can be pulverized. It also permits using, as the diluting substance, diamond powder or the like, which is not applicable to the KBr pellet method.

Application 2
LC Effluent Measurement

This method is also applicable to detection of substances dissolved in a volatile solvent, such as fractions of liquid chromatography. LC effluent is made to drop on KBr powder, the mobile phase is removed by evaporation, and then the fraction is analyzed with the FTIR instrument equipped with a diffuse reflectance attachment.



FTIR Analysis of HPLC Fractions

Application 3
Diffuse Reflectance Measurement in a Heated Vacuum

This can be used to measure samples in a high-temperature, vacuum, or reaction gas environment, which is useful for researching catalytic mechanisms, temperature dependency, zeolite, and so on. The measurement requires using a dedicated heated vacuum diffuse reflectance attachment. For information about heated vacuum diffuse reflectance attachments, contact your Shimadzu sales representative.

Diffuse Reflectance Attachment

DRS-8000A (P/N 206-62301-58)
DRS-8000 (P/N 206-62301-51)

The method of diffuse reflectance spectrometry is one of the most popular FTIR application methods of application of FTIR. It features high-energy throughput and simple operation.
The Shimadzu FTIR series incorporates, as standard, the Kubelka-Munk conversion functions, essential to diffuse reflectance spectrometry for correcting the light scattering by the KBr powder.
The IRTracer-100, IRPrestige-21, IRAffinity-1 series, IRSpirit and FTIR-8000 series systems incorporate as standard scattering correction functionality that is based on the Kubelka-Munk transformation.
DRS-8000A includes the automatic accessory recognition function.

Features

- The small measuring light beam (1.8 × 1.8 mm) ensures reliable analysis of small samples.
- The attachment is a drawer type, which ensures easy replacing.
- The standard data processing functions include the Kubelka-Munk conversion functions as standard.

Measurement Sample

- Powder

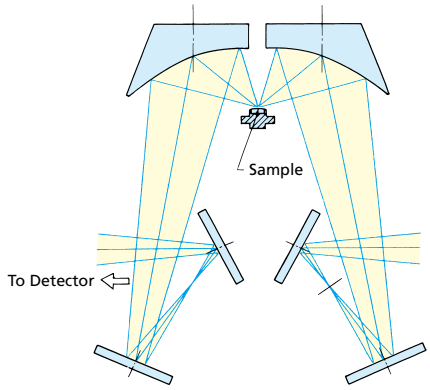
Standard Content

Description	P/N	Quantity
Diffuse reflectance attachment main unit		1
Sample holder 2 mm ID cup		1
Sample holder 4 mm ID cup		1
Aluminum cup holder*		1
Standard mirror	206-62232-01	1
Ground glass mirror	206-62232-02	1
Sample holding rod		1
Hex key wrench		1
Phillips screwdriver		1

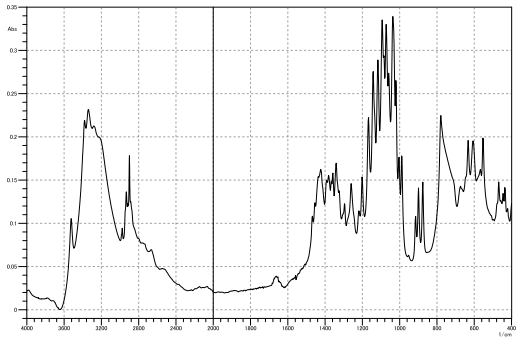
* Holder for disposable sample cup. Disposable sample cups are available as extra.

Options

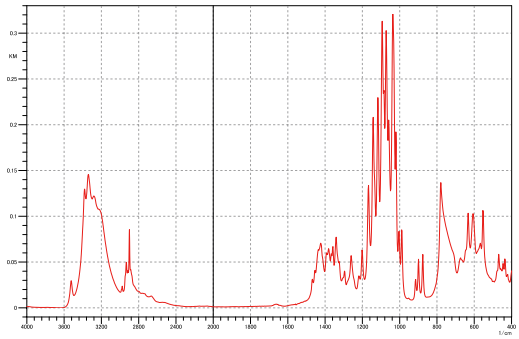
Description	P/N
Sample cup, 50 pieces per set, aluminum, 6 dia. × 1.5 deep (mm)	201-52943
Sample die for aluminum cup	206-63950
SiC sampler	200-66750-01



Optics of DRS-8000



Diffuse Reflectance Spectrum of Lactose



Diffuse Reflectance Spectrum of Lactose after Kubelka-Munk Conversion

SiC Sampler

(P/N 200-66750-01)

In diffuse reflectance spectrometry, it is necessary to pulverize the sample and mix the powder with KBr powder.
When the SiC sampler is used, the operation is simplified as follows:

Features

- Diluent such as KBr powder is not required.
- The solid sample is ground with SiC emery paper and the sample powder on the emery paper is directly analyzed with the DRS-8000. (The SiC has a hardness of 9.0 and is quite chemically stable.)
- Samples are measured left clinging to emery paper in a holder that is attached directly to the DRS-8000 series attachment.
- New emery paper is used as reference.

Measurement Samples

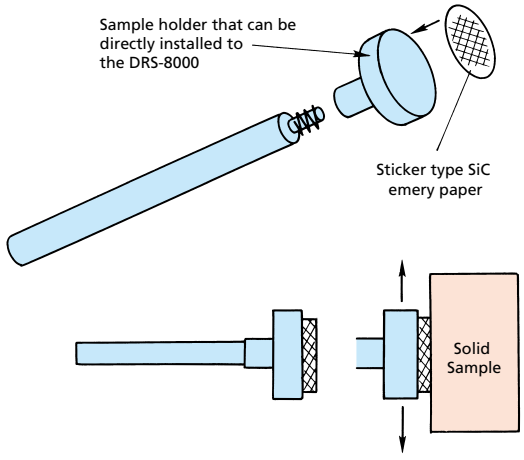
- Plastic molded parts

Standard Content

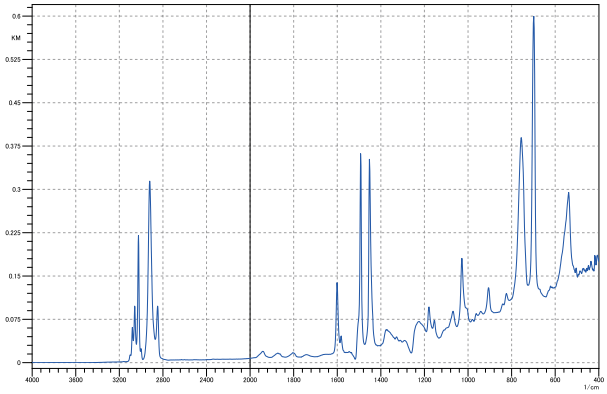
Description	P/N	Quantity
Holding rod		1
Sample holder	208-92176	2
SiC emery paper (#320)		100 sheets
SiC emery paper (#400)		100 sheets

Supplies

Description	P/N
SiC emery paper (#320), 100 sheets	200-66751-03
SiC emery paper (#400), 100 sheets	200-66751-02



Construction of SiC Sampler



Diffuse Reflectance Spectrum of Plastic Products Obtained with SiC Sampler

Automatic Diffuse Reflectance Attachment

DRS-8010ASC

(P/N 206-62308-91)

Having the same optics as the DRS-8000, the DRS-8010ASC accepts 24 samples to permit automated measurement.
The IRTracer-100, IRPrestige-21, IRAffinity-1 series, and FTIR-8000 series systems incorporate as standard a control output capability that eliminates the need for a special controller and enables a simpler system configuration.

Features

- One-touch connection to the main unit, which has the control capability as standard.
- With no external control unit required, the DRS-8010ASC is very compact.
- Controlled by Labsolutions IR or IRsolutions software.
- Manual control to reduce the frequency of opening the lid of the sample compartment is possible, resulting in higher analytical productivity.
- Use of the disposable sample cups ensures easy exchange of samples.

Notes

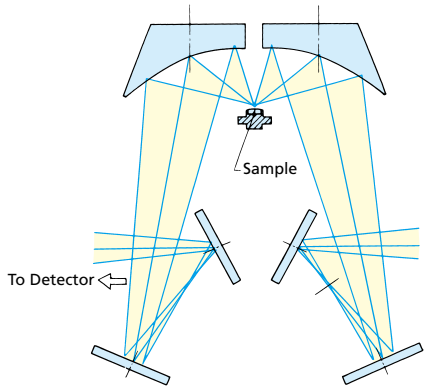
- When this attachment is used on IRAffinity-1S, the ASC cable (P/N 206-73433-41) is required.
- When this attachment is used on IRPrestige-21, the power unit (P/N 206-72018-91) is required.
- When this attachment is used on IRAffinity-1, the ASC cable (P/N 206-73433-91) is required.
- The BASIC software is required separately for the HYPER-IR model.
- When old version of DRS-8010ASC (P/N 206-62308) is used on IRTracer-100 and IRAffinity-1S, the ASC conversion connector (P/N 206-74385-41) is required.

Standard Content

Description	Quantity
Automatic diffuse reflectance attachment main unit	1
Sample holder, 24-sample type	2
Standard mirror	1 set
Sample cup	200
Die	1
Tweezers	1 pair
Sample handling rod	1
Hex key wrench	1
Phillips screwdriver	1

Options and Supplies

Description	P/N
Sample holder, 24-sample type	206-65234
Sample cup, aluminum, 6 dia. × 1.5 deep (mm)	201-52943



Optics of DRS-8010ASC

Sample stage of DRS-8010ASC

Micro Sample Measurement

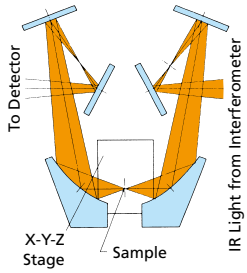
Measurement of Micro Samples

FTIR ensures such a high sensitivity as to permit reliable measurement of micro samples.
There are three popular devices to measure micro samples: single-reflection ATR, beam condenser and infrared microscope. The objects of measurement are classified as the selected small part of the sample and a small part of a sample of uniform composition; measurement is made in either the reflection mode or transmission mode. These may be tabulated as follows:

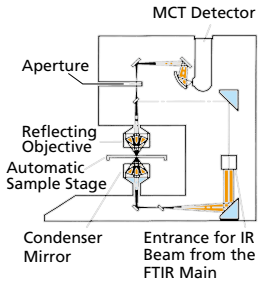
	Single-reflection ATR	Reflection-type beam condenser	IR microscope
Measurement mode	ATR only	Transmission only	Transmission/reflection/ATR
Selection of the part to be measured	Not possible	Not possible	Selection by aperture after observation in visual mode
Minimum measurable size	About a few hundred μm	About a few hundred μm	About 10 μm
Detector	Detctor of the FTIR (Measurement wavenumber range is limited by prism)	Detector of the FTIR	Dedicated MCT detector (Measurement wavenumber range is limited by the MCT detector.)
Installation	Sample compartment of the FTIR	Sample compartment of the FTIR	External installation

Transmission mode

As shown in the figures, both in the beam condenser and the IR microscope, the IR light beam from the interferometer is condensed by the optics and made incident on the sample. The light beam from the sample is expanded to the original size and condensed on the detector, and then measured with the detector.
The measurement principle of measurement is the same as that of ordinary samples, but in the case of micro samples, it is important to take the sample thickness into due consideration.
In measurement of 50 μm thick yarn samples, for example, if measurement is made without reducing the thickness, the detector signal will be saturated-resulting in deformed absorption bands. It is necessary to compress the sample using a diamond cell or the like.
Ordinary glass lenses are used for visual observation, while reflection mirrors must be used for IR measurement.



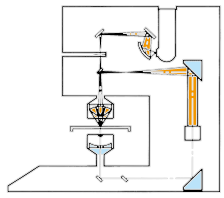
Beam Condenser



Infrared Microscope (Transmission Mode)

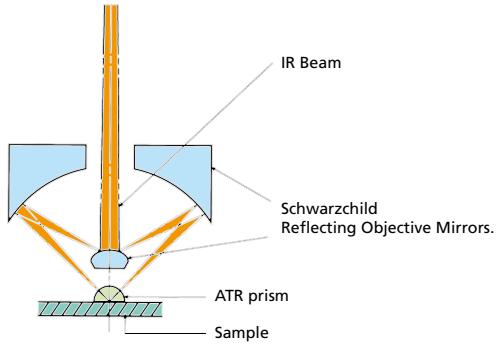
Reflection mode

Infrared microscopy is effectively used in reflection mode. As shown in the figure on the right, the IR light from the interferometer is condensed by the reflecting objective and made incident on the sample, and the reflected light travels back to the same objective to be sensed by the detector. The paths for the incident light beam and the reflected light beam are switched by the wedge mirror.
Though the measurement principle is the same as that of the samples of ordinary sizes, since the measurement is made on a very small area, specular reflection often occurs, resulting in abnormal peaks. The optics for visual observation and for IR rays are the same as that for the transmission mode.


Infrared Microscope (Reflection Mode)

ATR mode microscopy

The Attenuated Total Reflection (ATR) method is effectively used for samples that are opaque to IR rays, as well as for IR microscopy. It is especially effective for analysis of foreign materials on the resin surface and measurement of samples with curved surfaces.
As shown in the figure, a semicircular prism is placed at the focus of the reflecting objective, and the light totally reflected by the interface of the sample and prism is measured to obtain the IR spectrum.



Infrared Microscopes

AIM-9000 Narrow-Band MCT (P/N 206-32000-58)
Mid-Band MCT (P/N 206-32400-58)

Using an ideal, bright optical system and high-sensitivity MCT detector means micro samples can be measured with high sensitivity. The process was also automated, so that then entire series of steps involved in failure analysis can be performed more easily and quickly.

Features

- An ideal, bright optical system and high-sensitivity MCT detector enables high-sensitivity measurements.
- Reflection or ATR measurements can be performed for samples up to 40 mm thick.
- A wide-view camera (optional) and microscope camera can provide up to a 330x zoom function. That means measurements positions can be determined quickly.
- Equipped standard with an automatic contaminant recognition system that can determine measurement positions automatically.
- Up to 60 measurement positions can be recorded.
- Equipped standard with a contaminant analysis program for identifying the cause of failures.

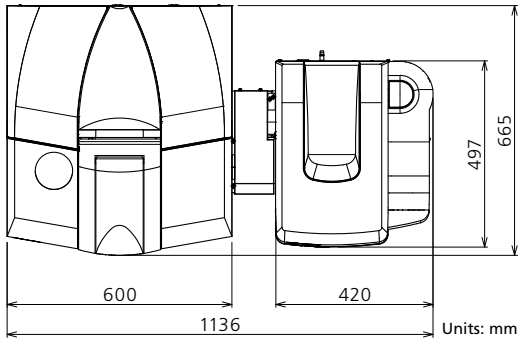
Notes

- Using this accessory requires the following parts.
  If connecting to theIRTracer-100:
  External beam switching kit (206-32570-41)
  AIM connection kit (206-32607-41)
  AIM-9000 accessory (206-32799-41)
  If connecting to the IRAffinity series:
  External beam switching kit (206-32570-42)
  AIM connection kit (206-32607-42)
  AIM-9000 accessory (206-32799-41)
- For mapping measurements, also purchase a mapping program (206-32936-41) separately.

Specifications

Measurement Mode	Transmission, reflection, or ATR
Optics	15x Cassegrain objective 15x Cassegrain condenser (with automatic adjustment mechanism)
MCT Detector	Wavenumber ranges: 5000 to 700 cm^{-1}(narrow-band) 5000 to 650 cm^{-1}(mid-band) Liquid nitrogen monitoring function: Includes a liquid nitrogen sensor
DLATGS Detector (optional)	Wavenumber range: 4,600 to 400 cm^{-1} Automatically switches between detectors, if equipped with multiple detectors
Observation and Measurement Support Functions	• Autofocus • Lower Cassegrain mirror automatic adjustment function • Automatic microscope ATR measurement (with purchase of pressure sensor) • Automatic aperture setting (automatic contaminant recognition system) • Zoom function (max. 330x digital zoom) • Multi-image tiling • Aperture settings can be specified for up to 60 points in microscope or tiled images.
Validation	Japanese Pharmacopoeia European Pharmacopoeia Chinese Pharmacopoeia Aperture size confirmation

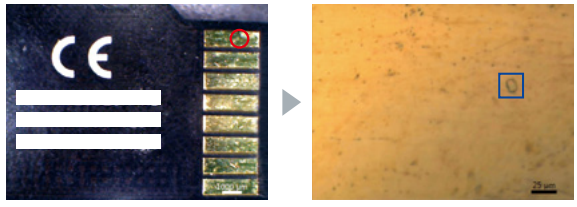
Automatic Failure Analysis System
(IRTracer-100 + AIM-9000)



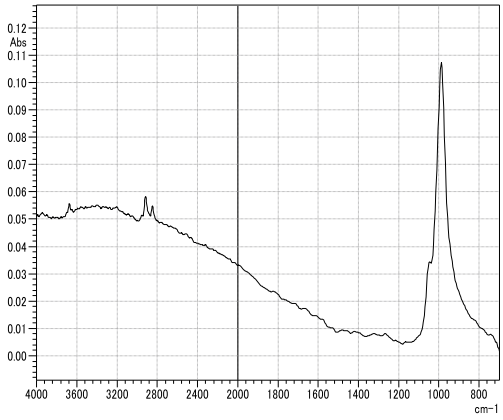
Layout of IRTracer-100 + AIM-9000 System

Overview Image of Electronic Parts via Wide-View Camera

Image of Contaminant on Terminal Viewed via 15x Cassegrain Objective Mirror



Contaminant Photos



Reflection Mode Spectrum of Contaminant Identified as Silicate

For AIM-9000
ATR Objective Mirror
(P/N 206-32600-41 (Ge)

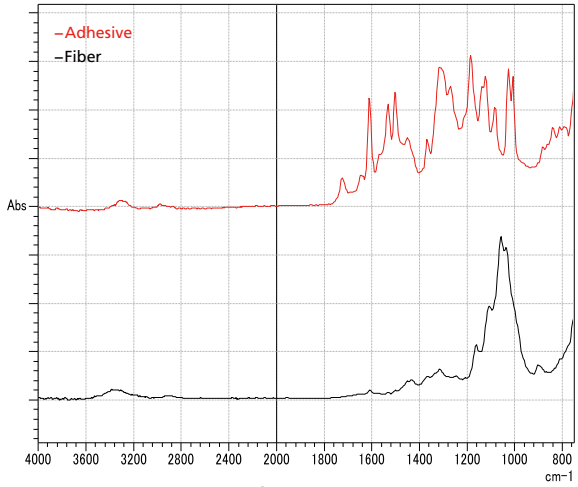
Using a cone-type prism, this single reflection objective mirror features 15x magnification and a 45-degree mean incident angle. The slide-on type prism makes it easy to switch back and forth between visible observation and infrared measurement. This ATR objective is especially effective in analyzing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

For AIM-8800
ATR Objective Mirror **(ATR-8800M)**
(P/N 206-70450-91)

This single reflection ATR objective mirror is for the AIM-8800/8000/8000R infrared microscopes.
Samples are measured by pressing them against a Ge prism of approximately 3 mm in diameter.
The magnification is 15x and incident angle is 30 degrees.

Maintenance Parts

Description	P/N
Replacement Ge prism	206-70451-91



Spectrum of Adhesive on Fiber

Micro Vise Holder
for AIM-9000 (P/N 206-33293)
for AIM-8800 (P/N 208-97202)

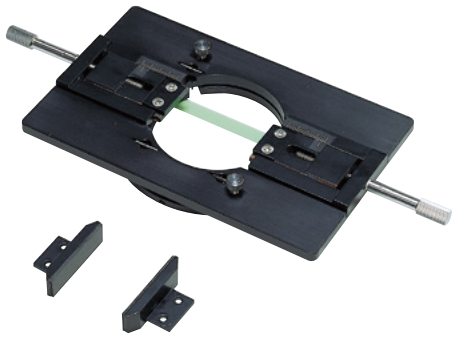
This holds various types of samples for microscopy. It ensures positive holding of samples of a difficult shape or measurement of a sample at a user-selectable angle. Measurement with a polarizer, with the sample under tensile load, provides information on the molecular orientation.

Sizes of Storable Samples

- Tensile load — Within approx. width of 20 mm
  Film of length 14 to 54 mm (excluding grip allowance)
- Gripped load — Max. approx. length 40 mm
  Approx. width 40 mm

Standard Content

Description	Quantity
Micro vise holder main unit	1
Holding fixture	2


Micro Vise Holder

For AIM-9000
ATR Pressure Sensor

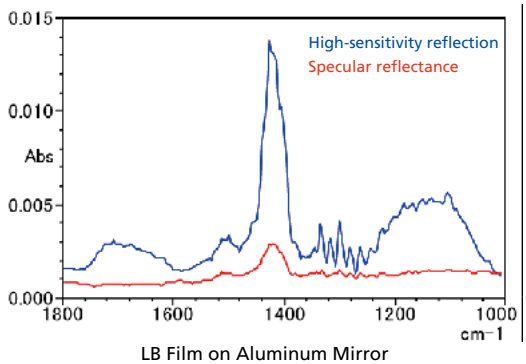
(P/N 206-32603-41)

This pressure sensor prevents prism damage due to excessive pressures applied during ATR measurements using an ATR objective. It can also be used to automatically measure how tightly the sample is pressed against the prism.

For AIM-9000
Grazing Angle Objective **(GAO)**

(P/N 206-32602-41)

This high-sensitivity objective mirror is useful for measuring samples with concave surfaces that cannot be pressed tightly against the ATR prism or samples that must be measured without contacting them. It is particularly beneficial for failure analysis of stains on circuit boards or extremely thin films on mirrors.

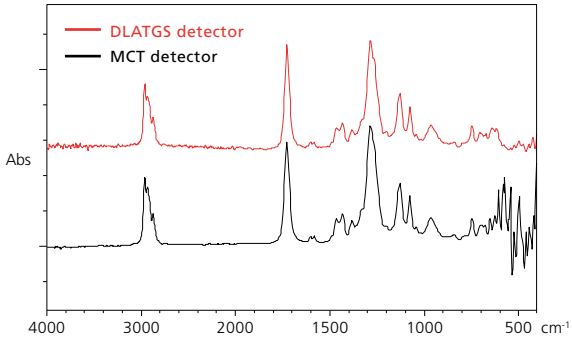


LB Film on Aluminum Mirror

For AIM-9000
Room Temperature Detector **(DLATGS)**

(P/N 206-32580-41)

By adding this DLATGS detector to an AIM-9000 infrared microscope, infrared spectra can be obtained without using liquid nitrogen. It is also possible to switch back and forth between the MCT and DLATGS detectors for measurements as needed. The DLATGS detector offers a broader measurement range (up to 400 cm^{-1}) than the MCT detector, but with lower sensitivity. Therefore, the MCT detector is better suited to measuring micro areas.

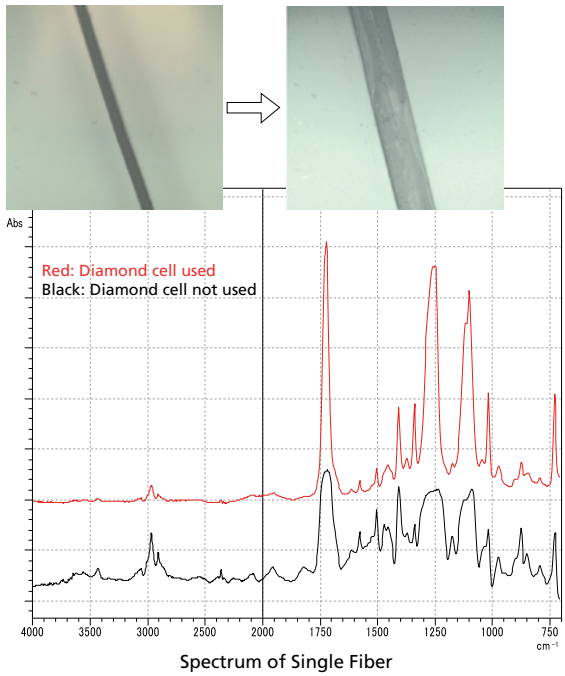


Infrared Spectrum of Polyvinyl Chloride (PVC)

Diamond Cell

This pressurized cell thinly compresses samples with a certain degree of thickness or minute samples placed on a microscope's stage to perform transmission measurement as they are. This cell is applicable to a variety of samples including drugs, rubber and plastic.

Notes
- Diamonds exhibit slight absorption in the range 3,000 to 1,500 cm^{-1}.
- Diamonds are hard but brittle and may crack depending on the sample and method of use.



Spectrum of Single Fiber

Diamond Cell C II (P/N 208-92289-01)

Features
- Artificial diamond used
- Large-size diamond provides 1.6 mm diameter window

Standard Content

Description	Quantity
C II plate	1
C II screws	3
Holder with diamond window for C II	2
Case	1

Options and Maintenance Parts

Description	P/N
C II plate	208-92289-13
C II screws (pack of 3)	208-92289-14
Holder with diamond window for C II	208-92289-11

Diamond Cell C II

Sampling Kit (P/N 208-92171)

This kit is for pretreating samples for microscope measurement.
It comprises a set of tweezers, roller knife, needles, scissors, replacement blades and replacement needles.

Standard Content

Description	Quantity
Tweezers (straight)	1
Tweezers (curved)	1
Roller knife	1
Needle (straight)	1
Needle (bent)	1
Needle holder	1
Scissors	1
Replacement blades (pack of 5)	1
Replacement needles (pack of 5)	1
Exclusive case	1


Sampling Kit

Other Microscope Options

Microscope	Description	P/N	Remarks
Both AIM-9000 and AIM-8800	Aluminum reference mirror	206-90104	13 mm dia.
	KBr window	206-66752-04	13 mm dia. × 2 mm thick
	CaF_2 window	206-66752-02	
AIM-9000	Infrared polarizer	206-32605-41	
	Visible polarizer	206-32540-41	
AIM-8800	Visible objective lens (10x)*	208-92286-01	Made by Shimadzu Rika, specifically for reflectance optics
	Visible objective lens (20x)*	208-92286-02	
	Infrared polarizer (requires infrared polarizer and holder)	206-81524	Infrared polarizer holder
		208-92014	Infrared polarizer (STJ-1001)

* Focal length is same as 15x Cassegrain objective mirror.

Reflection-Type Beam Condenser

RBC-8000 (P/N 206-62305-58)

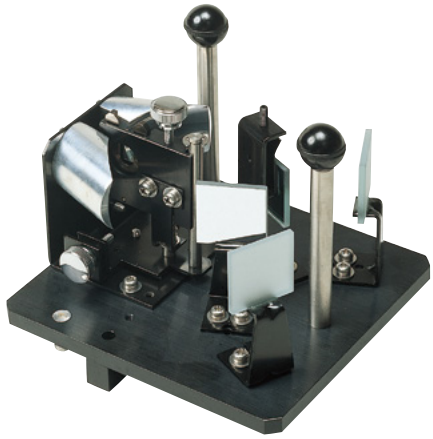
This beam condenser is especially useful for transmittance measurement of micro samples.

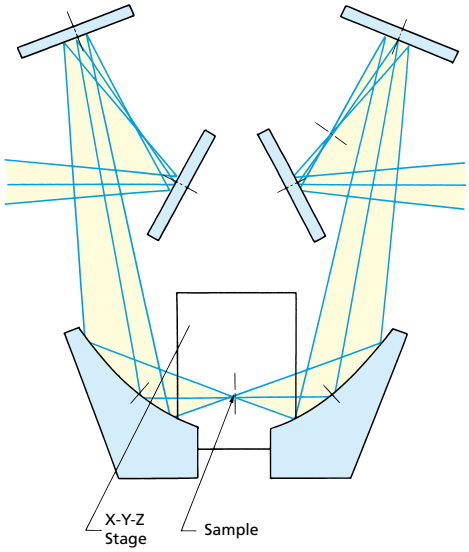
Features

- Since no lenses are used, measurement can be made over the entire wavenumber region of the FTIR instrument.
- Combined use with an ultramicro cell, 0.05 mm optical path, permits transmission measurement of 2 to 3 µL of liquid samples.
- The light beam is reduced to 1/5 (about 1.8 × 1.8 mm).

Standard Content

Description	Quantity
RBC-8000 reflection-type beam condenser main unit	1
Sample holder, with X-Y-Z stage	1
Pellet sample holder	1
Hex key wrench	1
Phillips screwdriver	1





Optics of RBC-8000

Accessories for Automated Measurement

Automating the Operation

The technique of Fourier Transform Infrared Spectrophotometry (FTIR) is now extensively used in various fields for R&D and industrial purposes.
Since samples measured by infrared spectrophotometry are mostly chemically stable and can be measured without pretreatment, it is fairly easy to automate the measurement of many samples.
Automating the measurement saves labor and ensures high analytical productivity.

Automating the FTIR Measurement

One of the most important methods to automate the operation of the FTIR main is to utilize a computer system.
Combination of a computer and the program, described below, provides automation of sample loading and unloading, measurement, data processing, and presentation of the analytical results.
The photo to the right shows the ASC connector equipped in the sample compartment of FTIR-8000 series (supplied as standard), which is used to export the control signals to an automatic sample changer. The software incorporated in the FTIR can control the automatic sample changer via a pair of the ASC connectors.

ASC Connector

Operation by Automated Sequence

The operation must be carried out in the sequence programmed to be most appropriate for the particular type of samples under study.
The Shimadzu FTIR-8000 series instruments incorporate, as standard, the SPECTROMACRO software, which permits flexible programming through simple procedures.
As for the FTIR-8200PC/8300/8400/8600PC/8700/8900 (HYPER-IR model) the optional BASIC software has the same functions as SPECTROMACRO.
IRTracer-100, IRPrestige-21, IRAffinity-1 series and FTIR-8400S which can be controlled by LabSolutions IR/IRsolution can also be controlled from the software.

Automatic Diffuse Reflectance Attachment

DRS-8010ASC

(P/N 206-62708-91)

This attachment automates measurement of up to 24 samples.
For details, refer to page 22.

Auto Sampler for Transmission Measurement

ASC-8000T

(P/N 206-63900-91)

This attachment accepts up to 18 samples for measurement in the transmission mode.

Features

- The control is made by the standard control signals from the FTIR main unit, meaning no external controller is required.
- Extenal control unit is not required.
- The attachment is easily installed in the standard sample compartment.
- A holder for a 13 mm dia. pellet is provided.
- Use of the KRS-5 window set enables measurement in the Nujol method.

Notes

- When this attachment is used on IRAffinity-1S, the ASC cable (P/N 206-73433-41) is required.
- When this attachment is used on IRPrestige-21, the power supply (P/N 206-72018-91) is required.
- When this attachment is used on IRAffinity-1, the ASC cable (P/N 206-73433-91) is required.
- The BASIC software is required separately for the HYPER-IR model.
- When old version of ASC-8000T (P/N 206-63900) is used on IRTracer-100 IRAffinity-1S, the ASC Conversion Connector (P/N 206-74385-41) is required.

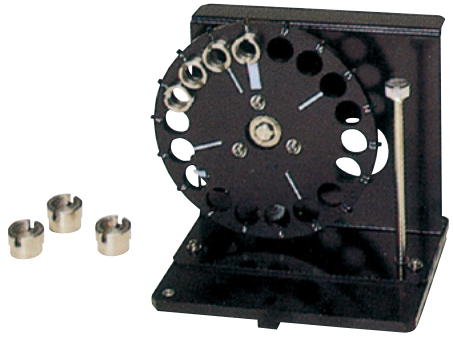
Standard Content

Description	P/N	Quantity
ASC-8000T main unit		1
Pellet holder	206-63917	20
Fixing spring	206-63951-01	20
Tweezers		1 pair

Options

Description	P/N
Film holder (9 pcs. as a set)*	206-81522

* Up to nine film holders can be installed on the ASC-8000T unit.



Sample Switcher 21

(P/N 206-63663-91)

(P/N 206-63663-92 except IRTracer-100 and IRAffinity-1S)

All the Shimadzu FTIR series spectrophotometers are single-beam type. This attachment allows any one of them to be operated in the "quasi double-beam mode" by switching two samples during measurement.

Features

- Two cassettes for liquid cells or pellet holders are provided.
- A built-in quasi double-beam mode is used, which eliminates the need for any special program.

Accessories That Can Be Used

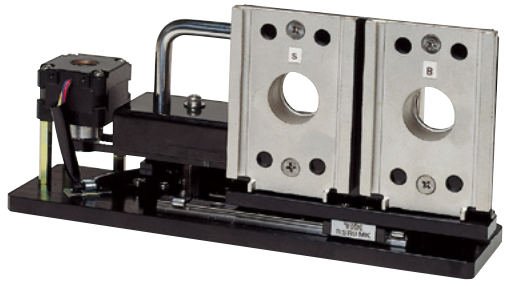
- Evacuable die for KBr pellets
- Sealed liquid cell
- Magnetic pellet holder
- Diamond cell
- Sample holder for MHP-1 Mini Hand Press
- Fixed thickness cell
- Magnetic film holder
- 5 cm gas cell

Accessories That Cannot Be Used

- 10 cm gas cell

Notes

- When this attachment is used on IRAffinity-1S, the ASC cable (P/N 206-73433-41) is required.
- When this attachment is used on IRPrestige-21, the Power unit (P/N 206-72018-91) is required.
- When this attachment is used on IRAffinity-1, the ASC cable (P/N 206-73433-91) is required.
- The BASIC software is required separately for the HYPER-IR model.
- When Sample Switcher 21 (P/N 206-63663-92) is used on IRTracer-100 and IRAffinity-1S, the ASC Conversion Connector (P/N 206-74385-41) is required.



Purge Control Kit

The FTIR series uses a sealed interferometer to ensure high sensitivity and stability during measurement without using dry air. To eliminate the interference of carbon dioxide and water vapor, it is recommended to purge the interferometer, the sample compartment, the second sample compartment, etc. through a combined use of the purge control unit and the dry air supply unit or nitrogen gas.

Purge Control Kit

This kit is for adjusting the piping between the FTIR and purge gas source, piping sections along which purge gas flows and the purge gas flow rate.

Description	P/N	Compatible Models
PCK-100	206-74251-41	IRTracer-100
PCK-21	206-72352-91	IRPrestige-21
PCK-8941	206-73512-41	IRAffinity-1, FTIR-8400/ 8400S/8900 series

This kit contains the following parts:

- Flow path and flow rate controller
- Purge tube (10 m, 7 mm I.D., 10 mm O.D.)
- Exhaust parts

Note

- Ventilate the site when purging with nitrogen gas.

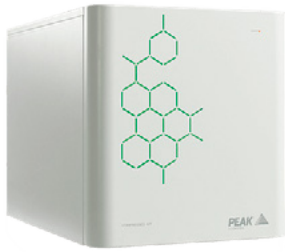
PCK-21

Dry Air Supply Unit

Interference of moisture in the FTIR body can be reduced with dry air supply unit. By combining a dry air generator with CO_2-free gas purification unit, it enables to supply gases with a CO_2 content of less than 1 ppm and a dew point of -70 ° C.

Specifications

Flowrate of purge gas: 30 L/min Max.
(14 L/min when using CO_2-free gas purification unit)
Content quantity of CO_2: No provisions (less than 1 ppm when using CO_2-free gas purification unit)
Environment temp.: 5 to 35 °C
Power supply: 110 VAC 50/60 Hz 11A
Dimension:
(W) 380 x (D) 540 x (H) 405 mm (Dry Air Supply Unit)
(W) 250 x (D) 160 x (H) 660 mm (CO_2-free Gas Purification Unit)



Dry Air Supply Unit

CO_2-free Gas Purification Unit

External Detector / Optional Detector

A DLATGS detector is mounted as standard on the IRTracer-100, IRPrestige-21 and IRAffinity-1 series. Some applications require use of a high-sensitivity MCT detector or external installation of a special optical system.

Required Parts

	When Using the MCT Detector	When Using an External Optical System
IRTracer-100 IRPrestige-21	MCT Kit	External Light Beam Switching Kit
IRAffinity-1 series	–	External Light Beam Switching Kit

External Light Beam Switching Kit

(P/N 206-32570-41 for IRTracer-100+AIM-9000)
(P/N 206-32570-42 for IRAffinity-1 series+AIM-9000)
(P/N 206-74250-41 for IRTracer-100+AIM-8800)
(P/N 206-70125-41 for FTIR+AIM-8800 except IRTracer-100)

This kit extracts infrared light from the right side of the IRTracer-100, IRPrestige-21, IRAffinity series and FTIR-8000 series, and switches the light to externally installed accessories such as an infrared microscope.
Also attached is a polystyrene film about 50 µm thick so that instrument validation can be filly automated based upon Japanese, European, Chinese Pharmacopoeia or ASTM. Note, however, that a separate standard sample must be prepared if traceability is required.

Standard Content

Description	Quantity
Switching mirror main unit (with polystyrene film)	1
External input signal connector	1set

Notes

- Traceability is not provided for the polystyrene film.
- This kit cannot be used on the FTIR-8100/8100M/8100A/8200/8200D/8200A/8500/8600 and FTIR-8200PC/8600PC.

MCT Kit

(P/N 206-74254-58 for IRTracer-100)
(P/N 206-72017-91 for IRPrestige-21)

A high-sensitivity MCT detector is used when analyzing minute or dark samples, or performing measurement using a long pathlength gas cell. This kit is an MCT detector unit for switching between the standard DLATGS detector. Switching of detectors is performed automatically from LabSolutions IR/IRsolution.
It has a built-in liquid nitrogen monitor to cut off current flow when the detector element is not being cooled, thus protecting the MCT detector. The liquid nitrogen dewar is made of glass and does not require reevacuation.

Specifications

Detector	Liquid nitrogen cooled MCT detector With glass dewar (approx. 300 mL) With liquid nitrogen monitor
Wavelength Range	5,000 to 650 cm^{-1}
Liquid Nitrogen Retention Time	8 hours (when liquid nitrogen is newly purchased)

Notes

- This kit cannot be mounted at the same time as the NIR kit (see page 41).
- Liquid nitrogen is required when using the MCT detector.

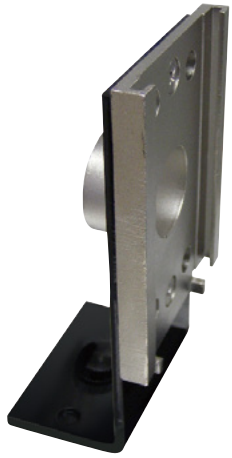
Transmission Measurement

Accessories for Transmission Measurement

Film samples can be measured easily if they are attached to the standard cassette or optional film holder.

Cassette (Sample Holder) (P/N 206-17384)

A cassette (sample holder) provided as standard on the FTIR can be used for options for attaching to cassettes for liquid and gas cells. However, with some accessories, there may be clearance between the cell and the cassette, which sometimes results in poor attachment reproducibility.
Also, bending sometimes occurs when heavy accessories such as the 10 cm gas cell are attached. Use this optional cassette when performing measurement with such accessories with better reproducibility.
This attachment cannot be used on the FTIR-8100/8100M/8100A/8200/8200D/8200A/8500/8600 and FTIR-8200PC/8600PC.



Features

- Little clearance
- Rigid

Standard Content

Description	Quantity
Cassette ASSY	1

Maintenance Parts

Description	P/N
Cassette mounting screws	037-02820-18

Magnetic-Type Film Sample Holder

(P/N 200-66754-11)

This holder holds films up to 0.5 mm thick. Film samples are held between the stainless backplate (SUS 430) and rubber magnet for direct analysis.

Standard Content

Description	Quantity
Backplate (SUS430)	1
Magnet sheet without hole	1
Magnet sheet with 13 mm dia. hole	1
Magnet sheet with 7 × 13 mm hole	1
Magnet sheet with 7 × 19 mm hole	1
Magnet sheet with 10 × 23 mm hole	1

Universal Clip Holder (P/N 208-97207)

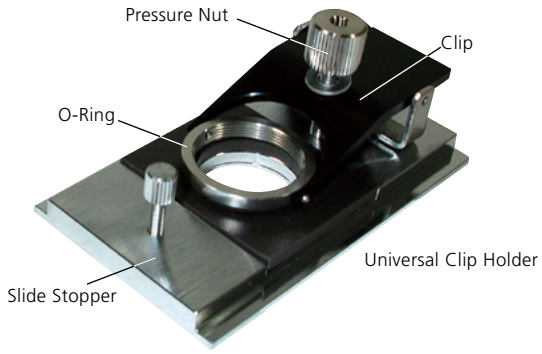
This holds a sample by one-touch operation through the use of a clip. A silicone rubber o-ring is used for positive contact and sample protection.

Features

- Applicable sample sizes range from 13 to 40 mm in diameter, and up to 13 mm thick.
- The pressure nut ensures easy measurement of mull samples.
- Thick samples (max. thickness 13 mm) also can be held.
- The rubber magnet and o-ring are used for positive holding of samples.
- Diameter of light passage hole: 10 mm

Standard Content

Description	Quantity
Universal clip holder	1
Magnet base, 22 mm dia.	1
Magnet base, 10 × 14 mm hole	1
Spare o-ring	1



Magnet Base (2 types)

Spare O-ring

EZ-Clip13 (P/N 208-97208)

This one-touch sample holder uses a clip exclusive for 13 mm dia. samples. An o-ring is located on the surface of the holder that contacts the sample to prevent damage to the sample.

Features

- Thick samples (max. thickness 13 mm) also can be held.
- Diameter of light passage hole: 10 mm

Standard Content

Description	Quantity
EZ-Clip13	1

EZ-Clip25 (P/N 208-97209)

This one-touch sample holder uses a clip exclusive for 25 mm dia. samples. An o-ring is located on the surface of the holder that contacts the sample to prevent damage to the sample.

Features

- Thick samples (max. thickness 13 mm) also can be held.
- Diameter of light passage hole: 10 mm

Standard Content

Description	Quantity
EZ-Clip25	1

Gas Cell

Gas cells are used when measuring gas samples. Select the optical pathlength to suit the concentration of the component.

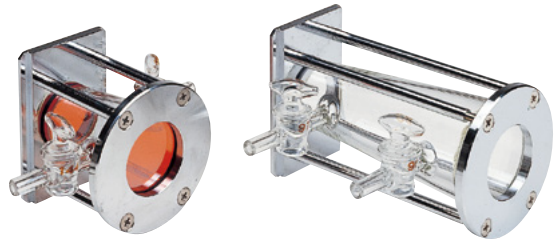
Short Pathlength Gas Cells

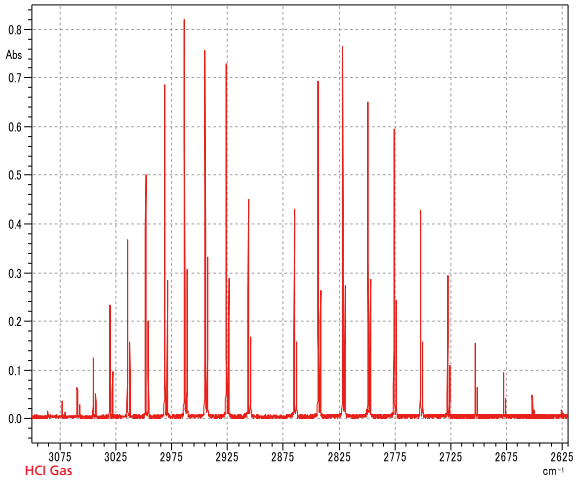
5 cm Gas Cell (P/N 202-32006-XX)
10 cm Gas Cell (P/N 202-32007-XX)

Used for measurement of gas samples or liquid samples of low boiling points. The cells are designed conic to make the inner volume smaller. The inner volumes of the 5 cm and 10 cm gas cells are 42 mL and 98mL, respectively. The last two digits of the catalog numbers show the material of the window plate, as listed below.

Cell Window Plates

Type of Window Plate	NaCl	KBr	KRS-5
Last two digits of P/N	-10	-20	-30

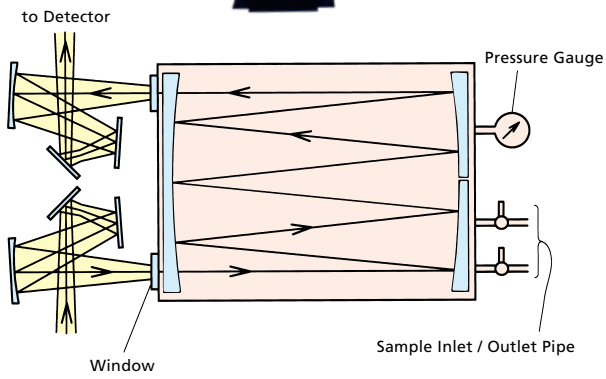




Spectrum of HCl Gas

Long Pathlength Gas Cell

A gas cell with a long pathlength is used when measuring low concentration gas samples. Inside a long pathlength gas cell, light repeatedly doubles back, which results in a long pathlength.
There are two types of long pathlength gas cells, one with a sample compartment and the other with a second sample compartment. A regular MCT detector is used as the detector.
The pathlength of long pathlength gas cells, gas cell material, window plate material, and detector must be selected according to the gas component, concentration, temperature, capacity, and other factors to be measured. When selecting a long pathlength gas cell, contact us so that you can select the appropriate cell.



Optics of Long Path Cell

Pellet Measurement

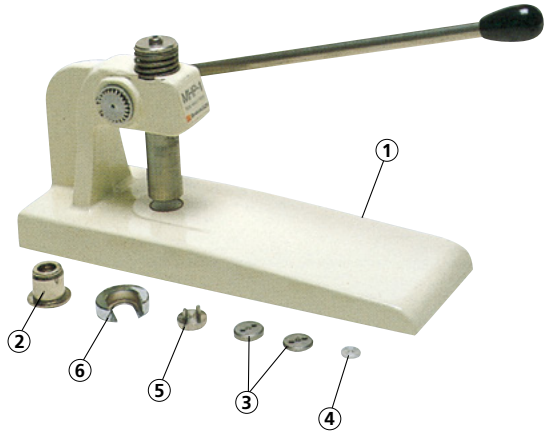
KBr Pellet Method

With this method, powder samples are diluted with KBr powder to produce pellets for transmission measurement. On the FTIR, the light intensity is large, so measurement is possible using pellets made easily with the Mini Hand Press. When making regular 13 mm dia. pellets, the evacuable die for KBr pellets, hydraulic press and vacuum pump are used.

Mini Hand Press

MHP-1 (P/N 200-66747-91)

This is a compact, inexpensive hand-driven press used to produce 4 mm dia KBr pellets.
A pellet produced in the frame is directly measured using the dedicated holder; this ensures exceptional simplicity of operation.
No dies or vacuum pump are required.



Standard Content

Description	P/N	Quantity
① Mini hand press		1
② Pellet holder	202-35258	1
③ Upper and lower cylinder	206-73717-91	1 set
④ Briquetting frame, 4 mm dia.		10
⑤ Pellet remover	200-66747-03	1
⑥ Pellet remover base	200-66747-04	1

* Parts other than ① Mini Hand Press are provided as maintenance parts.
②, ⑤ and ⑥ are shared for 4 and 3 mm dia. parts.

Options and Maintenance Parts

Description	P/N
4 mm dia. briquetting frame, 20 pieces	206-73718-91
3 mm dia. briquetting frame, 10 pieces Upper/lower cylinder set	200-66748
3 mm dia. briquetting frame, 20 pieces	200-66749-01

The following items are recommended for using MHP-1

Description	Quantity
KBr crystal	100 g
Agate mortar and pestle	1 each
Micro spatula	1

Evacuable Die for KBr Pellets (P/N 202-32010-58)

Used to prepare KBr pellets, 13 mm dia. The amount of KBr crystal necessary for one pellet is about 200 mg and the sample 1 to 2 mg.

Standard Content

Description	P/N	Quantity
① Base	202-35247	1
② Plunger guide	206-33129-58	1
③ Spring	202-35252	1
④ Plunger	204-21049	1
⑤ Mandrel	206-73889*	2
⑥ Die frame	202-35250*	4
⑦ Pellet holder	202-35258*	4
⑧ Punching rod	202-35256	1
⑨ Punching base	202-35255	1
⑩ Plug	202-35257	1
⑪ Sieve	202-35261	1

* Packet of one when ordering by this P/N.

The following items are recommended for producing pellets of high transmittance:

Description	Quantity
SSP-10A hydraulic press	1
SA18-3M vacuum pump	1
KBr crystal	100 g
Agate mortar and pestle	1 each
Micro spatula	1

Micro Die for 2 mm dia. KBr Pellets

(P/N 202-32011)

Micro Die for 5 mm dia. KBr Pellets

(P/N 202-32012)

Used in combination with the KBr die (P/N 202-32010-58), which is for 13 mm dia. pellets, to produce smaller pellets, 5 mm or 2 mm in diameter. Specify the diameter you require or the Cat. No. when placing an order.

Standard Content

Description	P/N	Quantity
① Mandrel for 2 mm dia. pellets	202-35262	2
Mandrel for 5 mm dia. pellets	202-35264	
② Die frame for 2 mm dia. pellets	202-35263	4
Die frame for 5 mm dia. pellets	202-35265	
③ Tool	202-35266	2
④ Pellet holder	202-35258	4

Note: Orders for the above P/N are for a quantity of one.

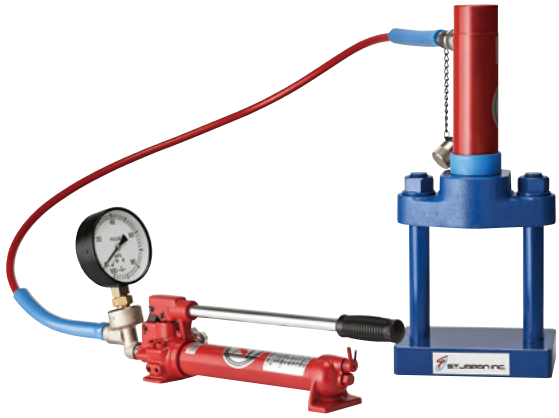
10-ton Hydraulic Press

(P/N 206-33547)

Used for producing KBr pellets. The maximum pressure is 10 tf/cm^2.
A high-precision pressure gauge is provided.

Specifications

Max. pressure capacity: 10 tons (at 700 kg/cm^2)
Total weight: 21.9 kg



Vacuum Pump

G-20DA **(P/N 206-36017)**

This is a compact rotary vacuum pump used for vacuum dehydration in production of KBr pellets.

Specifications

Exhaust velocity: 20/24 L/min (50/60Hz)
Ultimate pressure: 1.3 Pa
Size: 156.0 × 295.5 × 199.5 mm

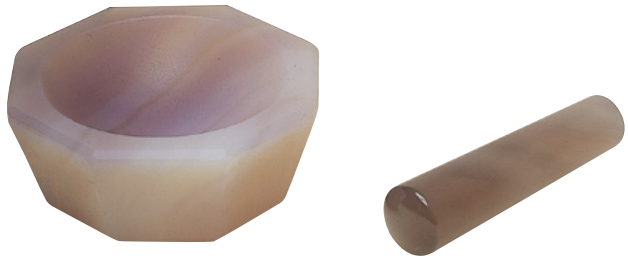
Magnetic-Type Pellet Holder

(P/N 200-66753-11)

13 mm diameter pellets are held between the stainless backplate (SUS430) and rubber magnet for direct analysis.

Agate Mortar and Pestle (P/N 200-93508)

Used to mix sample with KBr or Nujol using the KBr pellet method, diffuse reflection method, or Nujol method.
Size: 60 mm



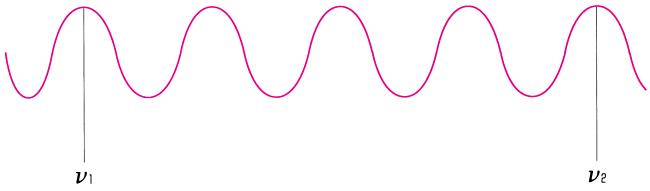
KBr Crystal (100 g) (P/N 202-34141)

Used to prepare KBr pellets. Features a long storage life, thanks to its low hygroscopicity.

Cells for Liquid Samples

Measurement Using Demountable Cells

Demountable cells, sealed liquid cells, fixed thickness cells, etc. are useful for measurement of liquid samples. In quantitative analyses, it is necessary to know the thickness of the cell accurately. Interference patterns are often used for the thickness measurement.



In transmission/reflection FTIR of thin films, an interference pattern as shown above is overlaid on the spectrum. The film thickness, t, is given by the next equation:

$$t = \frac{M}{2\sqrt{n^2 - \sin^2\theta}(\nu_1 - \nu_2)}$$

where ν_1 and ν_2 are the wavelengths of peaks or valleys, M is the degree of interference (number of the waves) between ν_1 and ν_2.

When the refractive index (n) of the film is known and is uniform between the ν_1 and ν_2, the cell thickness may be obtained from the above equation. In practice, the cell is measured without any sample in it, and its thickness is obtained by substituting n = 1 and θ = 0°.

Demountable Cell (P/N 202-32000-XX)

This type of cell is used for qualitative analysis of less volatile liquid samples, Nujol mulls, or film samples. The cell is assembled and disassembled in each analysis run.

P/N	202-32000-10	202-32000-20	202-32000-30
Type	NaCl Demountable Cell	KBr Demountable Cell	KRS-5 Demountable Cell
Contents	A pair of NaCl plates (201-97942)	A pair of KBr plates (201-97977)	A pair of KRS-5 plates (201-97943)
	Metal holder (201-77662) 1set 0.05 mm lead spacer (204-04900-14) 10sheets	0.025 mm lead spacer (204-04900-13) 10 sheets 0.1 mm lead spacer (204-04900-15) 10 sheets	

Sealed Liquid Cell (P/N 202-32001-XX)

This type of cell is used for measurement of volatile liquid samples. The cell is assembled sandwiching a spacer of the desired thickness, a sample is injected into the cell, and then drawn out with a syringe.
When it is necessary to prevent leaks of samples, the use of the fixed thickness cell is recommended.

P/N	202-32001-10	202-32001-20	202-32001-30
Type	NaCl Sealed Liquid Cell	KBr Sealed Liquid Cell	KRS-5 Sealed Liquid Cell
Contents	A pair of NaCl plates, with and without hole (201-77160-10)	A pair of KBr plates, with and without hole (201-77160-20)	A pair of KRS-5 plates, with and without hole (201-77160-30)
	Metal holder (201-77661) 1 set. Gasket (202-35425) 2 pcs. Lead cushion (202-35426) 2 pcs. Rubber cushion (202-35427) 2 pcs. PTFE stopper (201-75546) 2 pcs. Syringe (200-34835) 1 pc.	0.025 mm lead spacer (204-04901-13) 10 sheets* 0.05 mm lead spacer (204-04901-14) 10 sheets* (204-04901-34) for KRS-5 0.1 mm lead spacer (204-04901-15) 10 sheets* (204-04901-35) for KRS-5 0.5 mm lead spacer (204-04901-18) 10 sheets* (204-04901-38) for KRS-5	

* Four spacers are included if the corresponding sealed liquid cell is purchased. Ten sheets are included if the spacers are ordered separately with the above P/N.

Fixed Thickness Cell (P/N 202-32002-XX)

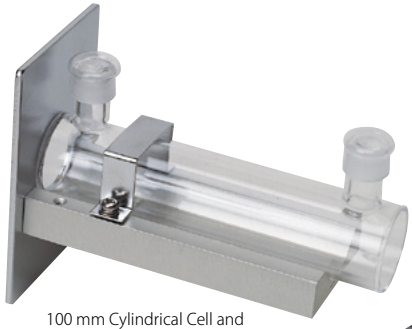
This type of cell is used for quantitative measurement of liquid or volatile samples. The cell is assembled in the Shimadzu factory to have the customer-specified cell thickness.
Matched pair of fixed thickness cells are also available.
The last two digits of catalog numbers indicate the type of cell window plates, as shown in the table below:
Example: The catalog number of the fixed thickness cell, 0.1 mm in thickness, KBr window plate, is 202-32002-25

Cell Window and Thickness

Thickness \ Type	NaCl	KBr	KRS-5
0.025 mm	-13	-23	Not available
0.05 mm	-14	-24	-34
0.1 mm	-15	-25	-35
0.2 mm	-16	-26	-36
0.5 mm	-18	-28	-38
1.0 mm	-19	-29	-39
2.0 mm	-11	-21	-31
5.0 mm	-12	-22	-32

Sample Cell for Oil Content Determination

Optional path length	P/N	Capacity	Quantity	Type of cell
100 mm	200-34473-02	38 mL	1	Oil content cell holder Type 1 (P/N 202-39897)
50 mm	200-34473-01	19 mL	1	
10 mm	201-98716	4 mL	a set of 2	Square cell holder (P/N 204-51216)
	200-34442		1	
5 mm	200-34449	2 mL	1 Spacer (204-21473-02) is required	
2 mm	200-34655	0.8 mL	1 Spacer (204-21473-01) is required	
1 mm	200-34660-01	0.4 mL	1 Spacer (204-21473-03) is required	



100 mm Cylindrical Cell and Oil Content Cell Holder

Square Cell Holder

Crystal Polishing Kit (P/N 202-32024)

This kit is used for polishing an NaCl and KBr window plate. The kit contains a polishing plate, abrasive, chamois and rubber gloves.

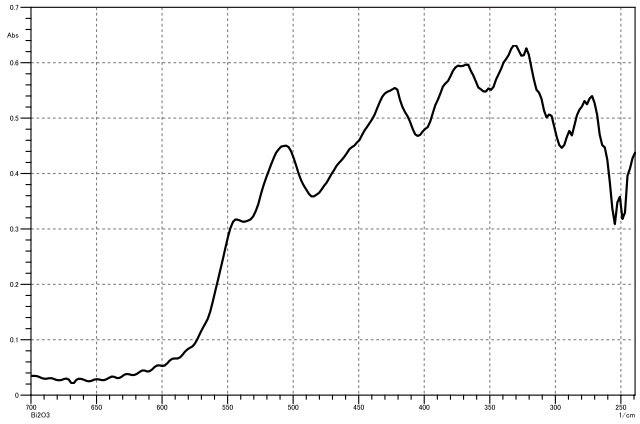
Note: Do not polish KRS-5 window plate.

Others

Far Infrared Kit

(P/N 206-30616-58 for IRTracer-100)
(P/N 206-30069-58 for IRPrestige-21)

In the far infrared region up to 240 cm^{-1}, peaks of inorganic compounds and organometallic complexes are observed. The Far Infrared Kit is a CsI beam splitter for measuring spectra in the far infrared region. Using the CsI beam splitter enables spectra in the far infrared region up to 240 cm^{-1} to be measured.
A standard light source and detector are used.
Since the 500 cm^{-1} to 240 cm^{-1} region absorbs lots of moisture in air, purge the instrument with dry air or dry nitrogen gas, for example, before performing measurement. Also, store the CsI beam splitter in a desiccator when it is not in use since it is extremely sensitive to moisture.
Window on the sample compartment should be replaced to KRS-5 window to use on IRTracer-100.



Far Infrared Spectrum of Bismuth Oxide

Feature

- Measurement wavelength range 5000 cm^{-1} to 240 cm^{-1}

Standard Content

Description	Quantity	
	for IRTracer-100	for IRPrestige-21
CsI beam splitter	1	1
KRS window	1	0

KRS-5 Window Set (P/N 206-74211-58)

The IRTracer-100 uses a KBr window with moisture-resistant coating for infrared light entering the sample compartment from the interferometer. When the window is replaced with a KRS-5 window, the system can be used in higher humidity environments with confidence. And this is used with Far Infrared kit to obtain spectra between 350 and 240cm^{-1}.
KBr beam splitter took out must be stored in a dedicator or dedicated storage box.

Standard Content

Description	Quantity
KRS-5 window	1

NIR Measurement

NIR Measurement Accessories for the IRTracer-100 and IRPrestige-21

Accessories are available for easier and higher-sensitivity NIR measurement of a wide range of samples. Each accessory is equipped with the Automatic Accessory Recognition function.
When the accessory is fitted to the sample compartment, the accessory type and its serial number are recognized automatically and the optimal measurement parameters are set.

Introduction to Near-Infrared (NIR) Analysis

In the near IR regions, absorption due to molecular vibration appears. Therefore, substances can be identified by comparing spectral patterns, and quantitatively determined from the peak intensity.
Absorbance is lower in the near IR region than in the mid IR region, so samples can be measured without dilution. The IRTracer-100 and IRPrestige-21, which employs the Fourier transform method and offers spectra with high wavelength precision, is optimal for identifying substances by comparing spectral patterns. Samples contained in glass or thin plastic containers can be measured directly. It is also possible to analyze a sample using a probe. Thus, sample pretreatment is easy, and the near IR measurement is also suitable for measuring samples that cannot be easily unpacked.
Note that the IRAffinity-1 series and FTIR-8000 series systems cannot be used for near-infrared measurements.

Near-Infrared Applications

Near-Infrared is used for qualitative and quantitative analysis, just as with the mid-infrared. Its applications include quality inspections of raw materials received, and endpoint quantitations for reaction processes.

Applications and Accessories

Multicomponent Quantitation of Liquid Samples

The quantities of various components in liquid pharmaceuticals and foods are measured and controlled. For example, quantitation can be made of the quantities of components such as sugar and proteins when manufacturing soft drinks. In this case, the location and shape of each component peak will depend on temperature. Therefore, measurement is conducted at a constant temperature using a heating transmission cell system. Here, the LabSolutions IR / IRsolution PLS Quantitation Program will be required to create the calibration curves.

Acceptance Inspections for Raw Materials (Qualitative)

When determining whether the correct raw materials have been delivered based on the spectral shape, select accessories in accordance with the form of the raw materials. After measurement, pass/fail determinations and library searches can be conducted using the PharmaReport program.
If the sample is a powder, use either diffuse reflection equipment UpIR A, near-infrared integrating sphere IntegratIR A, or a reflection-type fiber probe.
For liquid samples, pastes, pellets, and cloths, use near-infrared integrating sphere IntegratIR A.
For tablet samples (pharmaceuticals), use either near-infrared integrating sphere IntegratIR A or a reflection-type fiber probe.
For diffuse reflection equipment UpIR A and near-infrared integrating sphere IntegratIR A, the sample is prepared, and the prepared sample is then placed in the measurement window for measurement. Measurement can be conducted as is with the sample placed in the test tube included, or left in a plastic bag. In the latter case, however, there may be a significant impact from the bag's interference fringe.
If the reflection-type fiber probe is used, measurement is possible without sampling. The probe can be inserted directly into the sample, or measurement can be taken directly of a sample placed in a glass bottle or plastic bag. In the latter case, however, there may be a significant impact from the bag's interference fringe.

Difference Between UpIR A and IntegratIR A

Diffuse reflection equipment UpIR A and near-infrared integrating sphere IntegratIR A differ as shown below. The selection should be made on the basis of the experimental objective.

Benefits of IntegratIR A

1. The peak strength is several times stronger than for UpIR A, and the obtained spectrum has a superior S/N ratio.
2. Good data is obtained when measuring powdered samples in plastic bags.
3. Measurements can be conducted of pellets, pastes, tablets, liquids and cloth samples.

Benefits of UpIR A

1. Cost
2. Specialized for powdered sample analysis.

NIR Kit (P/N 206-74253-58 for IRTracer-100) (P/N 206-72015-91 for IRPrestige-21)

This option is attached to the IRTracer-100 and IRPrestige-21, enabling near-infrared measurement. Experiments are conducted via software that switches between the mid-infrared and the near-infrared. (Cannot be used with IRAffinity-1 series or FTIR-8000 series.)

Specifications

Measurement Range: 12,500 cm^{-1} to 3,800 cm^{-1}
Beam Splitter: Silicon-coated CaF_2
Light Source: Tungsten iodine lamp
Detector: InGaAs detector

Standard Contents

Deseription	Quantity
Beam splitter storage box	1
CaF_2 beam splitter	1

Topload Type Diffuse Reflectance Attachment UpIR A (P/N 208-97271-92)

- Powder samples can be placed on the sample stage for measurement.
- Pretreatment such as KBr dilution is unnecessary.
- Powders can be measured directly. Alternatively, directly set the sample contained in a plastic bag or glass bottle.
- Applications include qualitative or verification tests in acceptance inspections and quantitative analysis of components contained within samples.

Specifications

Measurement range: 10,000 to 3,800 cm^{-1}
Accessory recognition function: Included

Note

- When UpIR A (P/N 208-97271-91) is used on IRTracer-100, the Purge tube (P/N 208-97271-25) is required.

Standard Accessories

Deseription	P/N	Quantity
UpIR A main unit		1
Gold-coated mirror for reference	208-97271-41	1
Solid sample holder	208-97271-42	1
Powder sample holder	208-97271-43	1

Options

Deseription	P/N
Test tube with screw cap (pack of 200)	208-97271-20
Sapphire window	208-97271-21
Purge tube for IRTracer-100	208-97271-25

NIR Integrating Sphere IntegratIR A (P/N 208-97272-92)

- Pretreatment such as KBr dilution is unnecessary. Samples contained in a plastic bag or glass bottle can be measured.
- Applications include qualitative or verification tests in acceptance inspections and quantitative analysis of components contained within samples.
  Powders, tablets, liquids, pastes, fibers, plastic pellets and molded samples can be placed on the sample stage for measurement (reflectance measurement).
- A highly sensitive InGaAs detector is built-in.
- The IntegratIR installation kit or External light beam switching kit must be purchased separately.

Specifications

Measurement range: 10,000 to 3,800 cm^{-1}
Accessory recognition function: Included

Note

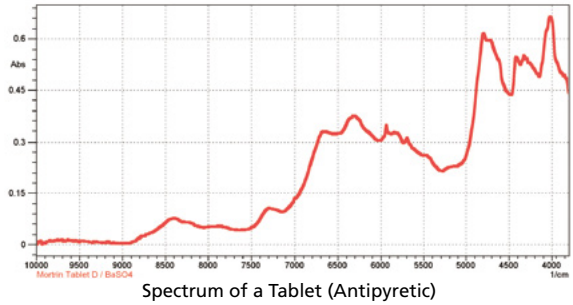
When IntegrantIR A (P/N 208-97272-91) is used on IRTracer-100, the Purge tube (P/N 208-97272-20) is required.

Standard Accessories

Deseription	P/N	Quantity
IntegratIR A main unit		1
Gold diffusion mirror with protective cap	208-97272-12	1
Test tube (pack of 25)	208-97272-14	2
Test tube holder	208-97271-17	1

Options

Deseription	P/N
Test tube (pack of 25)	208-97272-14
Purge tube for IRTracer-100	208-97272-20



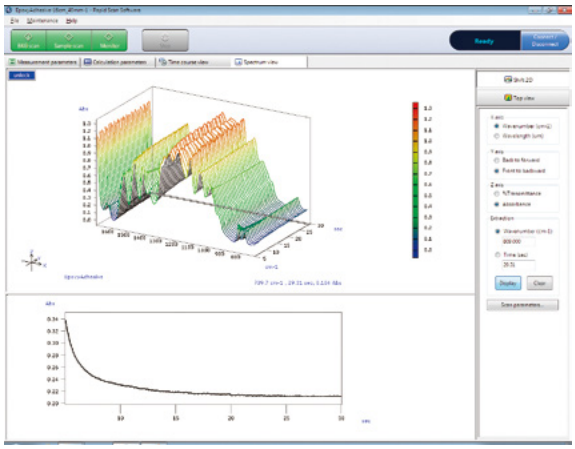
Spectrum of a Tablet (Antipyretic)

Optional Software

A variety of optional software is available for LabSolutions IR and IRsolution, the Windows-based FTIR control software that offers outstanding ease-of-operation and functionality. LabSolutions IR and IRsolution feature standard functionality that includes data processing functions, such as advanced ATR correction, subtraction spectra and Kubelka-Munk transform functions, quantitative analysis functions, such as multi-point calibration curve and multi-regression methods, and spectral search functions. Adding optional software programs allows extending the range of applications even further.
The time course software and CLASS-Agent connection kit are only for LabSolutions IR, and IRsolution Agent is only for IRsolution.

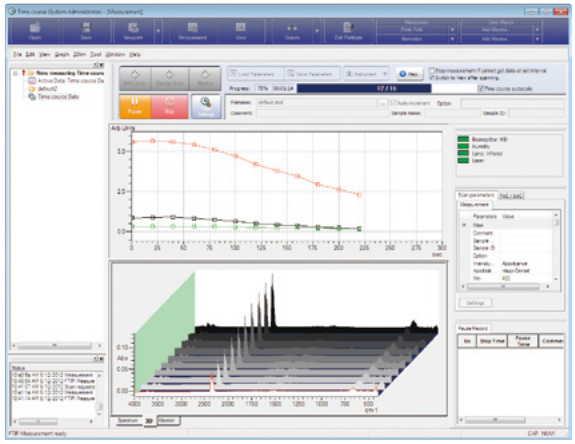
Rapid Scan (P/N 206-30200-91)

The Rapid Scan option provides the capability of collecting and recording a maximum of 20 spectra/second. This is especially suitable for fast reactions kinetics, where reactions are completed in a few seconds.
Spectra obtained from Rapid Scan measurements can be used to calculate peak heights and areas, which are used to determine kinetic rates.
The Rapid Scan interval is dependent on the resolution, number of scans, and mirror speed. The fastest speed under a 16cm^{-1} resolution and a mirror speed of 40mm/s is 0.05 seconds for 1 accumulated scan. Maximum measurement time depends on scan parameters.
The 3D Processing Program is required for analysis of Rapid Scan spectra.



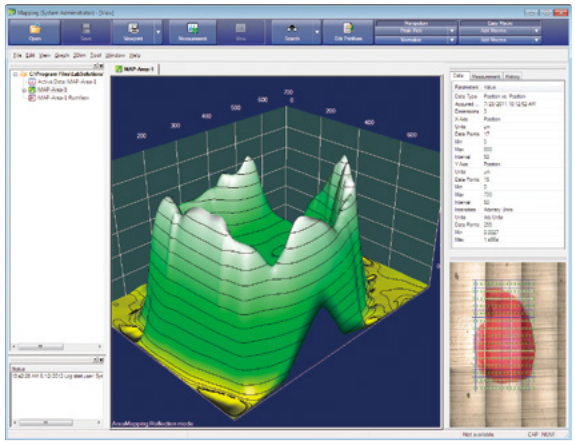
LabSolutions IR
Time Course Software (P/N 206-74558-91)

The time course program is used to collect spectra in regular intervals and creates a time course dataset used to follow reactions as a function of time. Changes in peak height and peak area can be used to calculate values related to reaction kinetics.
Time course information is saved and displayed in 3D (bird's eye view) or in a contour plot. Simply modify parameters to recalculate the information.
The scan interval is dependent on resolution, number of scans, and mirror speed. The fastest speed under a 8cm^{-1} resolution and a mirror speed of 9mm/s is 7seconds for 1accumulated scan. The time course software includes a 3D Processing Program.



Mapping Program
AIM solution (P/N 206-32936-41)
LabSolutions IR (P/N 206-74559-91)
IR solution (P/N 206-73738-91)

The Mapping software allows mapping of absorption information on a sample surface as a function of position when using the Shimadzu AIM-9000/8800 Infrared Microscope.
The program allows setting of mapping parameters, such as the mapping range, the scan intervals, and the background positions, on the composite images. In addition, it supports area mapping, line mapping and random mapping modes.
In addition to mapping in the conventional transmittance and reflectance modes, micro-ATR mapping with an optional ATR objective is also available. From the acquired mapping data, it is possible to extract spectra and to perform calculations for functional-group mappings for specific peaks. The data can be displayed as 3D images or contour plots, or in spectral overlay mode.
This program includes a 3D Processing Program.

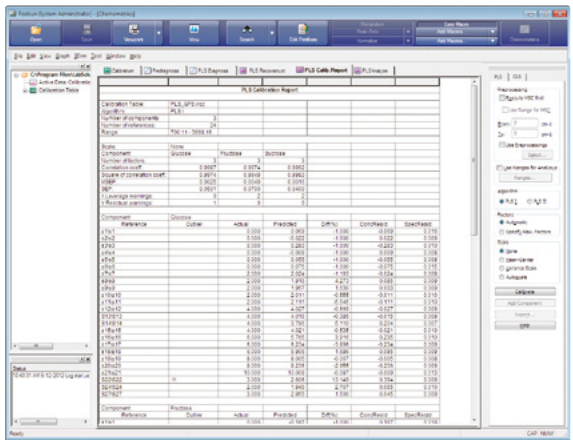


Example of Mapping Program Using LabSolutions IR

PLS Quantitation Program

LabSolutions IR (P/N 206-74560-91)
IRsolution (P/N 206-73736-91)

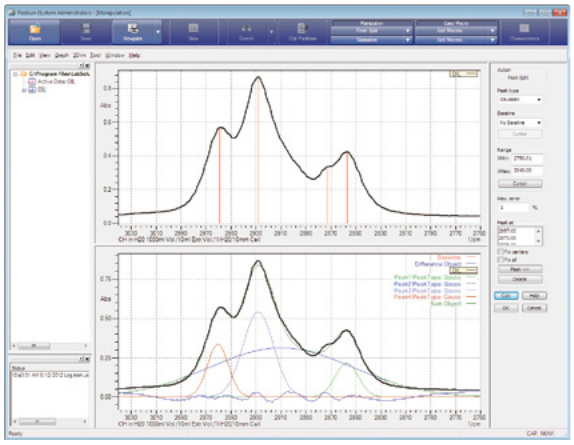
Like multiple linear regression analysis, PLS (partial least squares) is a chemometrics method widely used for the simultaneous quantitation of multiple components. The PLS quantitation program incorporates PLS I and PLS II methods. It is possible to display calculation values based on input values. PLS factors are based on "PRESS" values, loading vectors, and score values. Analysis can be performed on the regression equations obtained with the PLS method.



Curve-Fitting (Peak-Splitting) Program

LabSolutions IR (P/N 206-74561-91)
IRsolution (P/N 206-73739-91)

Usually, absorption bands in infrared spectra consist of overlapping peaks. The curve-fitting (peak-splitting) program can be used to separate absorption bands into individual peaks, separate peaks that have been influenced by hydrogen bonding, and identify the peaks of functional groups that are hidden by absorption bands. Six types of curves, including Gaussian, Lorentzian, and Gaussian+Lorentzian, are available for separation analysis.
The curve can be selected in accordance with the form of the peaks in the absorption band. The separated component peaks are displayed together with the resultant spectra making it possible to evaluate the separation accurately.

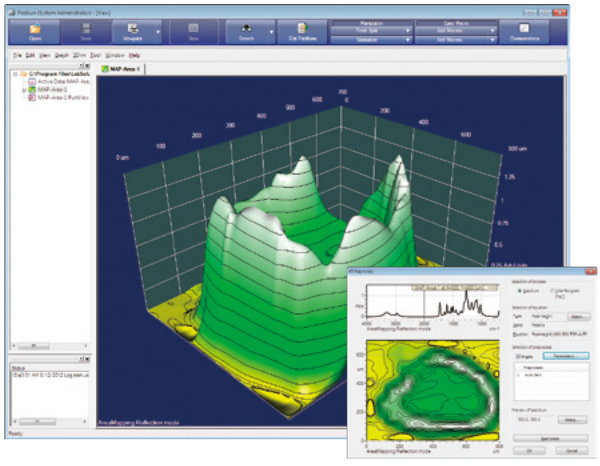


3D Processing Program

LabSolutions IR (P/N 206-74563-91)
IRsolution (P/N 206-73737-91)

The 3D processing program offers the following functionality:

- Changes the method of displaying data
  - Display data in bird's eye view (3D), as an intensity distribution or using contour lines, as a spectral overlay, or rotated.
- 3D data processing
  - Isolate changes at specific wavenumbers.
  - Functions include data extraction, data points thinning, smoothing, zero-baseline, background correction, normalization, log conversion, first- or second-order derivative, and ATR correction.
- Creation of 3D data from spectra
  - Create 3D data by consecutively arranging spectra measured at fixed intervals, such as by repeated measurements.



* The 3D processing program cannot control mapping measurements or infrared microscopes.

Macro Platform

For LabSolutions IR (P/N 206-74562-91)
For IRsolution (P/N 206-73735-91)

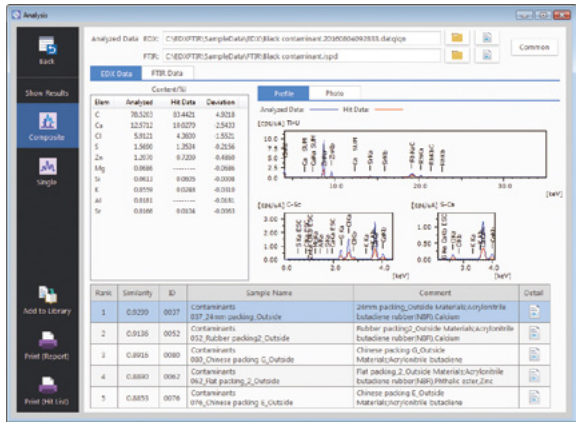
Customized macro programs can be prepared by Shimadzu (for a fee). A macro platform is required for running customized macro programs. For procedures that cannot be accomplished using simple macro program functionality, for automatic measurement systems that include an auto sample changer, or for other requirements, contact your Shimadzu sales representative.

EDXIR-Analysis Software (P/N 206-33175-XX)

English (P/N 206-33175-92) Chinese (P/N 206-33175-93)

EDXIR-Analysis software is specially designed to perform qualitative analysis using data acquired by an energy dispersive X-ray (EDX) fluorescence spectrometer and a Fourier transform infrared spectrophotometer (FTIR). Simply click "Analyze Both Data" and select the EDX/FTIR data. This heightens the efficiency of data analysis and provides strong support for contaminant analysis. In addition, it is equipped with a data comparison function, which calculates the degree of matching between the actual measured data and the data registered in the library. The library used for data analysis is original to Shimadzu, and consists of the data acquired by Shimadzu FTIR and Shimadzu energy dispersive X-ray (EDX). Additional data can be registered, edited and deleted. Furthermore, image files of contaminant data and document files in PDF format acquired by other instruments can be linked and stored. It is also effective for the linked storage of contaminant data as electronic files.

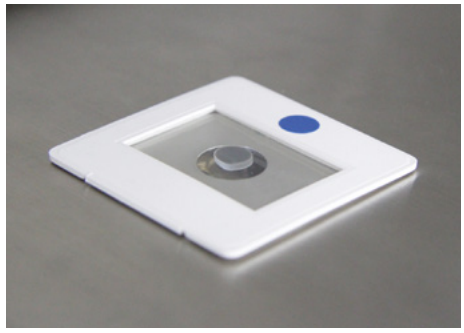
Operating System: Microsoft Windows 7 Professional 32/64-bit
Microsoft Windows 10 Pro 64-bit



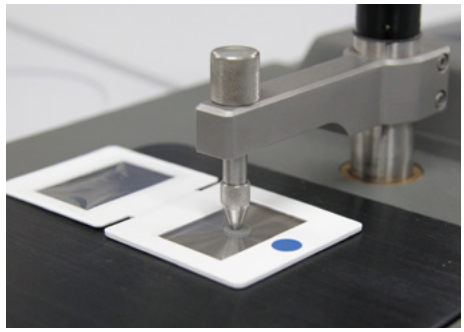
Integrated Data Analysis Results

Sample Holder/Stocker for Contaminant Measurement EDXIR-Holder (P/N 212-25890-41)

This foldable holder consists of an adhesive layer with samples attached and a polypropylene film designed for fluorescence X-ray. When using EDX for measurement, close the holder and place the polypropylene film directly to the irradiation side (downside). When using FTIR for measurement, open the holder and press the samples attached to the adhesive layer against the ATR prism. This enables the replacement of samples, at a minimum, saving on labor and making analysis more efficient. Close the holder after the measurement and it can be used as a sample stocker. It is not necessary to transfer the samples to other containers, so there is no danger of losing samples.



Measurement with EDX



Measurement with FTIR

Materials for Cell Window Plate

Sample cells have a window made of various materials to meet the requirements of your analyses, such as wavenumber range and physical and chemical characteristics of the sample.
The characteristics and features of the materials popularly used for the window of sample cells are described below. Some of the materials are used only rarely due to the difficulty of processing and high costs.

Materials of Sample Cell Windows

Material	Wavenumber Range cm^{-1} (μm)	Refractive Index (1000 cm^{-1})	Water Solubility at 20°C (g/100 g H_2O)	% Transmission (thickness)	Max.Temp. (Melting Point)	Knoop Hardness (200 g)
KBr	40,000~340 (0.25~29.4)	1.52	65	90 (5 mm)	300 (730)	7.0<100>
NaCl	50,000~600 (0.2~16.6)	1.49	36	90 (5 mm)	400 (801)	18.2<100>
KCl	40,000~500 (0.25~20.0)	1.46	34	90 (10 mm)	(776)	9.3<100>
CsI	33,000~200 (0.3~50.0)	1.74	44 (0°C)	90 (5 mm)	200 (621)	—
KRS-5 (TlBr+TlI)	16,600~250 (0.6~40.0)	2.37	0.05	70 (2 mm)	200 (414)	40.2
ZnS	10,000~725 (1.0~13.3)	2.2	Insoluble	70 (1 mm)	300 (1,180 Sublimate)	354
ZnSe	10,000~550 (1.0~18.1)	2.4	Insoluble	65 (1 mm)	350 (1,700)	250
BaF_2	50,000~770 (0.2~12.9)	1.42	0.004	90 (1 mm)	500 (1,280)	82 (500 g)
CaF_2	50,000~1,100 (0.2~9.0)	1.39 (2,000 cm^{-1})	Insoluble	95 (3.6 mm)	900 (1,402)	158 (500 g)
Si	8,000~660 (1.25~15.1)	3.4	Insoluble	55 (2.5 mm)	300 (1,420)	1,150
Ge	5,500~660 (1.8~16.6)	4.0	Insoluble	50 (2 mm)	270 (936)	780
Diamond,type II	40,000~12.5 (0.25~800)	2.38	Insoluble	70 (1 mm)	(400)	10 Mohs Scale
SiO_2 (Fused Silica)	50,000~2,500 (0.20~4.0)	1.42 (3,000 cm^{-1})	Insoluble	85 (1 mm)	1,710 Soften	500

%Transmission values given are typical ones, in the wavenumber range applicable to the respective materials, including the loss due to surface reflection.
Max. Temp. values given assume atmospheric conditions.

Characteristics of Cell Window Materials

- Only the main characteristics of the cell window materials are described below.
- The "Clean-up" lists present only the representative solvents used to wash the cell windows. Even if a solvent is listed as "Clean-up", confirm that the solvent does not react with the samples.
- The "Harm" solvents can destroy the window plate through corrosion or dissolving. Some solvents not listed as "Harm" can be harmful to the material.

KBr
(Potassium Bromide)

- Low cost and wide wavenumber range.
- Easy to process with alcohol anhydride.
- Most popularly used.
- High mechanical strength.
- Store under humidity conditions lower than 50%.

"Clean-up": chloroform, carbon tetrachloride

"Harm":
•Aqueous solution • Lower alcohol

NaCl
(Sodium Chloride)

- Most inexpensive.
- Wide wavenumber range.
- Store under humidity conditions lower than 50%.

"Clean-up": chloroform, carbon tetrachloride

"Harm":
•Aqueous solution • Lower alcohol

KCl
(Potassium Chloride)

- Similar characteristics as NaCl and KBr.
- Not popularly used.

CsI
(Cesium Iodide)

- Soft and hence liable to injure.
- Applicable to analysis in far-infrared region.
- Highly deliquescent.
- Store under humidity conditions lower than 40%, and handle with care.

"Clean-up": chloroform, carbon tetrachloride

"Harm":
• Aqueous solution • Lower alcohol

KRS-5
(Thallium Bromide-Iodide)

- Wide wavenumber range.
- High refractive index.
- Most widely used for ATR prisms.
- Almost insoluble in water.
- Toxic; must be processed at an authorized
- manufacturer's site.

KRS is an abbreviation of "Kristalle ausdem SchmelzfuB" ("crystals that don't melt" in German).

"Clean-up": chloroform, carbon tetrachloride, xylene

"Harm":
• Acetone • Ammonium salt solution • Sulfuric acid, ammonia, EDTA • A solution of a compound that reacts with thallium to form a complex

ZnS
(Zinc Sulfide)

- Non-water soluble.
- Resistant against mechanical and thermal shocks.
- High refractive index.
- Effectively used for evaporation depositing.

"Clean-up": acetone, alcohol

"Harm":
• Acidic solution

ZnSe
(Zinc Selenide)

- Non-water soluble.
- Resistant against weakly acidic or alkaline solution.
- Applicable pH range: 5-9
- High refractive index.
- Used for ATR prisms.
- If used for measuring acidic samples, harmful hydrogen selenide may be generated.

"Clean-up": acetone, H_2O

"Harm":
• Acidic solution • Strongly alkaline solution

BaF_2
(Barium Fluoride)

- Soluble in acidic solution and ammonia.
- Usable up to 500°C.
- Almost insoluble in water.

"Clean-up": acetone, H_2O

"Harm":
• Ammonium salt solution • Acidic solution

CaF_2
(Calcium Fluoride)

- Soluble in ammonium salt solution.
- Resistant against acidic or alkaline solution.
- Hard, high mechanical strength.
- Suitable for high-pressure cell.
- CaF_2 that occurs in nature is called fluorite.

"Clean-up": acetone, H_2O

"Harm":
• Ammonium salt solution • Strongly acidic solution

Si
(Silicon)

- Widely used as the material for semiconductors.
- Rarely used as cell window material.
- Ge can substitute Si as cell window material.

"Clean-up": acetone, H_2O

"Harm":
• HF-HNO_3 mixture

Ge
(Germanium)

- Widely used as the material for semiconductors.
- Useful as the material for vapor deposition.
- Easily processed to be lenses.
- High refractive index, suitable as the material for ATR prism used in analysis of highly refractive samples.
- Non-watersoluble.

"Clean-up": toluene, H_2O

"Harm":
• Hot sulfuric acid

Diamond Type II
(Diamond)

- Harder than any other material.
- Applicable to wavelength range from ultraviolet to far infrared, though a gradual absorption is seen in the range from 3000cm^{-1} to 1500cm^{-1}.
- Natural diamond is classified as Type I and Type II, and only the Type II is used as the material for cell window.
- Extremely expensive.
- Recommended for the window of high-pressure cell.

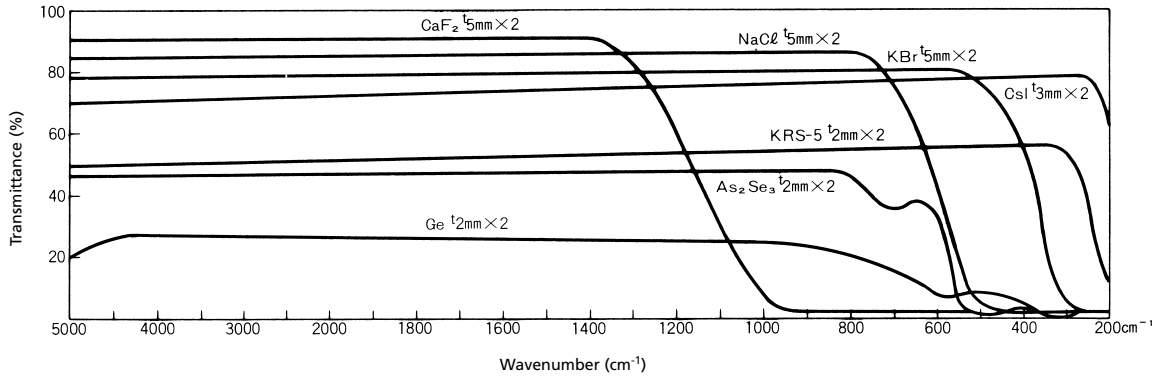
"Clean-up": ethanol, acetone

SiO_2
(Fused Silica)

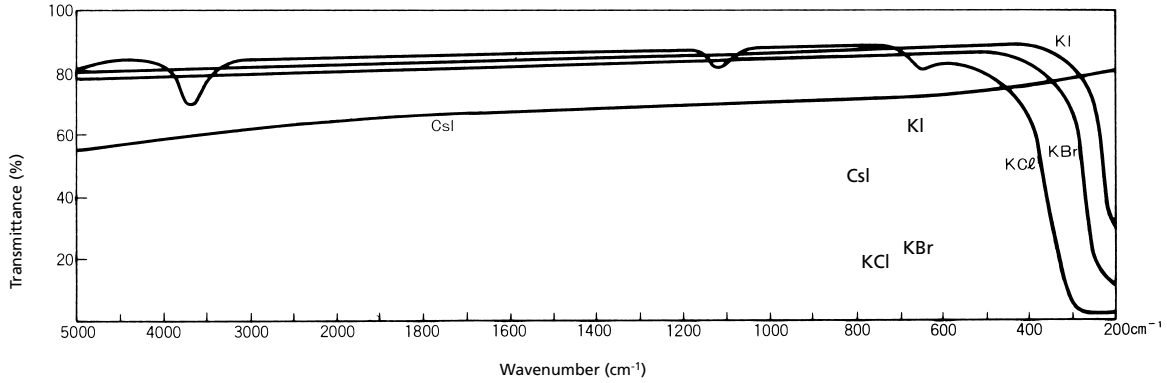
- Effective for analysis in the ultraviolet and visible regions.
- Though useful up to 4 μm in the IR region, this material ensures high stability and is easy to process.

"Clean-up": ethanol, acetone

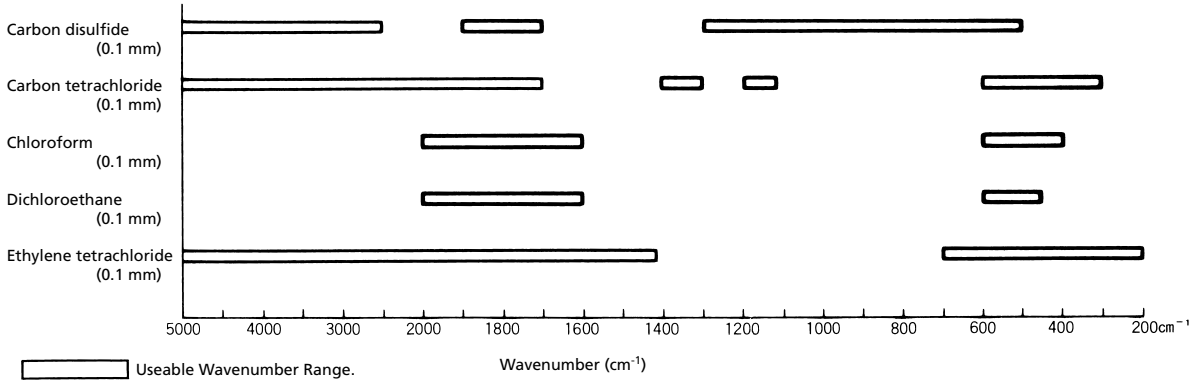
Transmittance Characteristics of Representative Cell Window Materials



Transmittance of Alkali Halide Pellet (1 mm thick)



Wavenumber Range of Solvent.



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