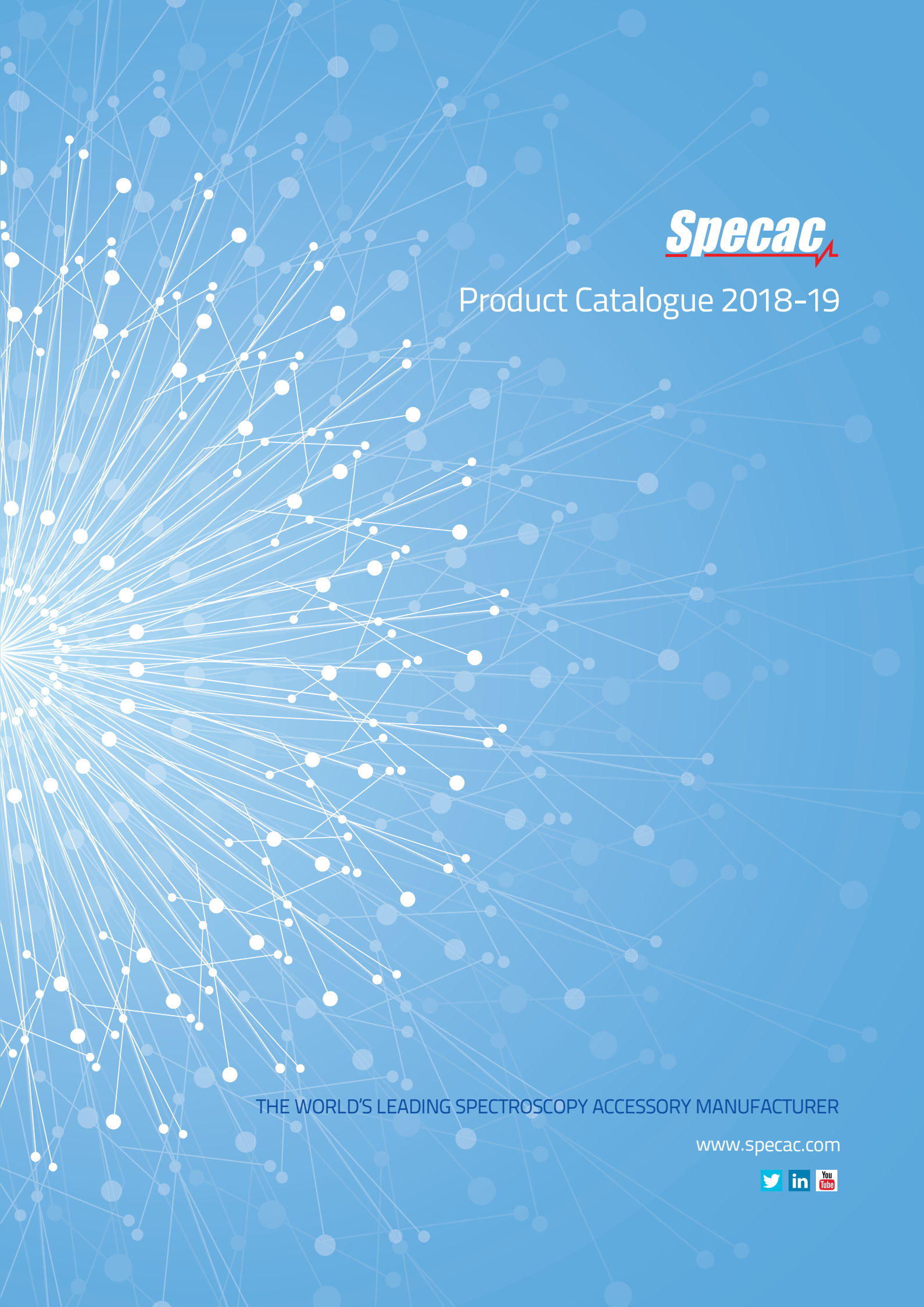


Specac

Product Catalogue 2018-19

THE WORLD'S LEADING SPECTROSCOPY ACCESSORY MANUFACTURER

www.specac.com

inside front cover

Contents

Specac: a clear focus on innovation, product quality and customer service.

Welcome to the Specac 2018/19 catalogue.
My name is David Smith, and I've had the privilege of leading Specac as Managing Director since 2008.

We are a very different company to 2008 and have made significant strides commercially. We have done this by focusing on innovation, quality and customer service. We have launched numerous new products since 2009 and these are now nearly two thirds of our total yearly sales. We feel we've made a strong connection with the desire in the market for something new.

We have bold plans to become a larger company, providing more accessories to help our existing and new customers to solve their application problems. We will launch a raft of new products, some with the label of a partner organisation on them, however most will be Specac branded accessories.

If you're visiting a trade show in the next couple of years, and Specac is exhibiting, please visit our booth, there'll be something exciting and new for you to have a look at.

As we grow as a company, we are employing more staff. That includes more sales personnel, marketeers and design engineers, and it also means more back office staff.

We are investing in our infrastructure, with particular focus on customer service, and over the next couple of years we will build up our after sales support. We are pleased to have launched a new website with an up-to-date and bright look and feel. This is indicative of the bold and fresh approach that we take to everything we do. We will be adding e-commerce to the website this year, alongside all of the marketing materials that we hope are of use to you.

Customers are now finding Specac and approaching us with new ideas for solutions. These are very exciting times for Specac as we continue to travel the world enabling great science.

David Smith, Managing Director

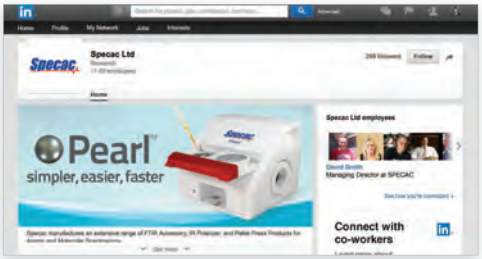
Specac has the ideal sampling solution - whatever your application. And be assured we are working on new innovative products now, to enable great science.

Stay in contact with Specac 24/7.

Stay in touch, with the latest developments at Specac around the clock.

With our team of spectroscopists, engineers and chemists, you can be assured of unrivalled technical back-up and applications advice, giving complete peace of mind with every Specac purchase.

And through our social media presence you can get the latest Specac news via Twitter, stay in contact with us through LinkedIn and Facebook and watch our latest instructional videos on YouTube.



Key to catalogue symbol usage.

The symbols below indicate the service requirements for Specac accessories.

Electric power is required for this accessory

Communications option on the 4000 Series Controller is available with this accessory

Gases are used with this accessory

Essential spares kit is offered with this accessory (ESK)

Vacuum Pump kit is required for this accessory

This accessory is Benchmark™ Baseplate compatible

Cooling water required for this accessory (see Thermocirculator Pump with 5 litre bath **GS11127**)

Cooling water required for this accessory (see Thermocirculator Pump with 12 litre bath **GS11128**)

Water heating required for this accessory (see Thermocirculator Pump with 5 litre bath **GS11127**)

Specac Product Selector

For virtually any sample type, there is a Specac accessory for either the transmission or reflection technique. This table will help you identify the best accessory for your sampling application and shows which accessories can be used for various sample types under various conditions. (Additional accessory options where indicated).

Key
- ★ Ideal for application
- ❖ May be suitable; (contact Specac for further details)
- Requires additional accessory

		Reflection								
		ATR				Diffuse		Specular		
		Quest™	Golden Gate®	Gateway™	25 Reflection	MiniDiff™ Plus	Selector™	30° Fixed Angle Unit	Monolayer Grazing Angle	HTHP Cell
Solid	Flat/smooth	★	★	★	★	❖	❖	★	★	★
	Rough/abrasive	❖	★	❖	❖	★	★			★
	High temperature		★	★			★			★
	Low temperature		★							
	High pressure		★				★		★	
Powder	Finely ground	★	★	★		★	★			★
	Coarse/crystalline	❖	★	❖		★	★			★
	High temperature		★	★			★			★
	Low temperature		★							
	High pressure		★			★	★			★
Liquid	Fixed pathlength		★							❖
	Variable pathlength									
	Ambient conditions	★	★	★						❖
	Flow experiments		★	★						
	High pressure		★	❖						❖
	High temperature		★	★						❖
	Low temperature		★							
	pH <4 or >11	❖	❖	❖	❖					❖
Gas	Fixed pathlength						❖			★
	Variable pathlength									
	High pressure						❖			★
	High temperature						❖			★
	pH < 4 or > 11						❖			★
Advanced Research	Reaction		★				★			★
	Catalysis		❖				★			★
	Supercritical		★							
	Part number	GS10800	GS10500	GS11165	GS11000	GS04510	GS19900	GS19820	GS19650	GS05850 GS05855
	Spectral range	Mid/Far IR								

Golden Gate® advanced applications

GS10642 High Temperature Golden Gate®
GS10507 Reaction Cell Top Plate
GS10514 Specular Reflectance
GS10566 Germanium Top Plate
GS10585 Super Critical Top Plate
GS10590 Low Temperature Top Plate

The Selector™

GS19930 Environmental chamber

Liquid Cells

GS21525 Variable Temp. Cell Holder
GS21530 Variable Temp. Cell Holder
GS20730 Electrical Heating Jacket

Cyclone™

GS24302 C2 Heating Jacket
GS24305 C5 Heating Jacket
GS24310 C10 Heating Jacket

Key
★ Ideal for application
❖ May be suitable; (contact Specac for further details)
Requires additional accessory

		Transmission									
		Liquid Cells					Solid Cells		Gas Cells		
		Pearl™ Liquid Analyser	Omni Cell™	High Pressure Liquid Cells	Sealed Heatable Cell	Demountable Heatable Cell	Solids Holder	DC Cell & Microfocus Beam Condenser	Tornado™	Cyclone™	Storm™
Solid	Flat/smooth						★	★			
	Rough/abrasive						❖	★			
	High temperature						★				
	Low temperature						★				
	High pressure						❖				
Powder	Finely ground	mull	mull					★			
	Coarse/crystalline	mull	mull					❖			
	High temperature										
	Low temperature						★				
	High pressure										
Liquid	Fixed pathlength	★	★	★	★	★		gum			
	Variable pathlength	★	★	★		★					
	Ambient conditions	★	★	★	★	★					
	Flow experiments			★	★	★					
	High pressure			★	★	★					
	High temperature			★	★	★					
	Low temperature			★	★	★					
	pH <4 or >11	❖	❖	★	★	★			❖	❖	❖
Gas	Fixed pathlength								★	★	★
	Variable pathlength									★	
	High pressure								★	★	★
	High temperature									★	★
	pH < 4 or > 11									❖	❖
Advanced Research	Reaction										
	Catalysis										
	Supercritical			❖							
	Part number	GS31000 Series	GS01800 Series	GS05910	GS20500 Series	GS20510 Series	GS20600 GS20610	GS02555 GS02560	GS242XX	GS241XX	GS05000 GS05800 GS05670
	Spectral range	UV / Vis / IR									

Analysing soil samples

SPECAC APPLICATION NOTE

Soil can be analysed at a range of temperatures, easily, with the Golden Gate® ATR accessory.

FTIR spectroscopy can be used to study the chemical profile of soil samples, providing information on both the organic and inorganic components.

In particular, you can determine what natural chemicals or artificial contaminants are present in soil quickly after sampling and testing at various temperatures.

When coupled with an Attenuated Total Reflectance (ATR) accessory, spectroscopic measurements are fast and repeatable. The ability to distinguish different soil types makes the ATR technique invaluable for forensic, environmental, agricultural and other applications.

The Golden Gate® requires minimal sample preparation. Pellet-pressing and grinding are not necessary, the ATR accessory accepts samples in their native state.

This particular note demonstrates how the Golden Gate® ATR accessory (with a heated top-plate) can be used to record spectra of soil samples at different temperatures.

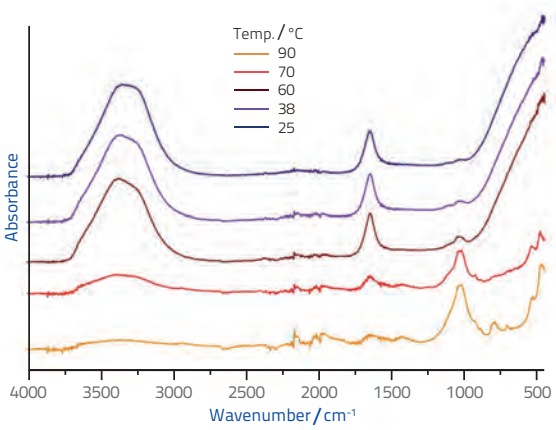
Method

10 mg samples of soil were taken from the banks of the River Cray in Orpington, UK. They were then placed onto the Specac Golden Gate® ATR for spectroscopic analysis.

Spectra were recorded at different temperatures, from 25-90°C, using the Golden Gate® accessory's heated top-plate function.

The broad absorption bands at around 3300 cm^{-1} and 800 cm^{-1} and the sharp peak at 1600 cm^{-1} indicate the high concentration of water in the soil samples. As the temperature increases these bands decrease in intensity, indicating the water is evaporating.

The mineral features around 500cm^{-1} become uncovered. The different samples contained different concentrations of clay, as indicated by the varying intensity of the Si-O stretch at 1040 cm^{-1}.



The Heated Golden Gate® accessory can go to higher temperatures to monitor the chemical breakdown of the soil and detect released gases such as CO_2.

CONCLUSION

The Golden Gate® ATR accessory is ideal for the ATR analysis of soil. Heating the soil was easy and practically no sample preparation was needed.

This kind of method allows the testing of soil for the presence of heavy metals, clay, chemicals and other pollutants or significant contents.

FT-IR Starter Kits

Get started with a Specac FT-IR starter kit

Specac provide a number of sampling kits for FT-IR spectroscopy. These off-the-shelf kits are composed of different combinations of infrared sampling accessories to equip a laboratory with the necessary spectroscopic accessories for specific or varied sample analysis.

Basic Starter Kit

P/N GS01140

P/N GS01150

ordering information

Basic Starter Kit

GS01180 **Basic Starter Kit**
consists of
GS01140 **Liquid Pack**
and
GS01150 **Basic Solid Pack**

Optional Gas Pack add-on

P/N GS01170

GS01181 **Basic Starter Kit** plus **Gas Pack** add-on

Liquid Pack (contents)

GS01110 Luer Syringe 2ml
GS01800 Omni-Cell™ assembly
GS01811 KBr windows (pair) for liquids
GS01812 CaF2 windows (pair) for liquids
GS01831 KBr windows (pair) for Mulls
GS01864 10 off assorted PTFE Liquid Cell spacers
GS01871 5 off PTFE 0.1mm Mull Cell spacers
GS03620 Bottle of Nujol (25ml)
GS03621 Bottle of Fluorolube (25ml)

Basic Solid Pack (contents)

GS03940 Mini-Pellet Press (2T)
GS03950 7mm Pellet Die with Pellet Ring Holder
GS03951 7mm spare Pellet Ring Holder
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03960 7mm Disc Holder with rectangular mount

Analyst Starter Kit

P/N GS01140

P/N GS01160

ordering information

Analyst Starter Kit

GS01185 **Analyst Starter Kit**
consists of
GS01140 **Liquid Pack**
and
GS01160 **Advanced Solid Pack**

Optional Gas Pack add-on

P/N GS01170

GS01186 **Analyst Starter Kit** plus **Gas Pack** add-on

Liquid Pack (contents)

GS01110 Luer Syringe 2ml
GS01800 Omni-Cell™ assembly
GS01811 KBr windows (pair) for liquids
GS01812 CaF2 windows (pair) for liquids
GS01831 KBr windows (pair) for Mulls
GS01864 10 off assorted PTFE Liquid Cell spacers
GS01871 5 off PTFE 0.1mm Mull Cell spacers
GS03620 Bottle of Nujol (25ml)
GS03621 Bottle of Fluorolube (25ml)

Advanced Solid Pack (contents)

GS15011 15T Manual Hydraulic Press
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03410 13mm Disc Holder with rectangular mount
GS03000 13mm Evacuable Pellet Die

Research Starter Kit

P/N GS01140

P/N GS01150

P/N GS10802

ordering information

Research Starter Kit

GS01190 **Research Starter Kit**
consists of
GS01140 **Liquid Pack**
GS01150 **Basic Solid Pack**
and
GS10802 **Quest™ ATR ZnSe**

Optional Gas Pack add-on

P/N GS01170

GS01191 **Research Starter Kit** plus **Gas Pack** add-on

Liquid Pack (contents)

GS01110 Luer Syringe 2ml
GS01800 Omni-Cell™ assembly
GS01811 KBr windows (pair) for liquids
GS01812 CaF2 windows (pair) for liquids
GS01831 KBr windows (pair) for Mulls
GS01864 10 off assorted PTFE Liquid Cell spacers
GS01871 5 off PTFE 0.1mm Mull Cell spacers
GS03620 Bottle of Nujol (25ml)
GS03621 Bottle of Fluorolube (25ml)

Basic Solid Pack (contents)

GS03940 Mini-Pellet Press (2T)
GS03950 7mm Pellet Die with Pellet Ring Holder
GS03951 7mm spare Pellet Ring Holder
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03960 7mm Disc Holder with rectangular mount

Advanced Starter Kit

P/N GS01140

P/N GS01160

P/N GS10802

ordering information

Advanced Starter Kit

GS01195 **Advanced Starter Kit**
consists of
GS01140 **Liquid Pack**
GS01160 **Advanced Solid Pack**
and
GS10802 **Quest™ ATR ZnSe**

Optional Gas Pack add-on

P/N GS01170

GS01196 **Advanced Starter Kit** plus **Gas Pack** add-on

Liquid Pack (contents)

GS01110 Luer Syringe 2ml
GS01800 Omni-Cell™ assembly
GS01811 KBr windows (pair) for liquids
GS01812 CaF2 windows (pair) for liquids
GS01831 KBr windows (pair) for Mulls
GS01864 10 off assorted PTFE Liquid Cell spacers
GS01871 5 off PTFE 0.1mm Mull Cell spacers
GS03620 Bottle of Nujol (25ml)
GS03621 Bottle of Fluorolube (25ml)

Advanced Solid Pack (contents)

GS15011 15T Manual Hydraulic Press
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03410 13mm Disc Holder with rectangular mount
GS03000 13mm Evacuable Pellet Die

FT-IR Individual Application Packs

FT-IR individual Application Packs

Our individual application packs are built around a range of key accessories which have a proven track record:

Liquid Pack: The versatile Omni-Cell™ System is at the core of the Liquid Pack which contains all the essential accessories that a spectroscopist needs for the analysis of liquids, gums and pastes.

Basic Solid Pack: This pack is built around the Mini-Pellet Press and includes all the necessary tools for the preparation of 7mm diameter KBr pellets. The Mini-Pellet Press' hydraulic operation enables the pressing of high quality KBr pellets and the integral pressure gauge ensures repeatability.

This lightweight, portable KBr sample press has a small footprint and can be transported to different work stations or easily stored.

Advanced Solid Pack: The Specac 15T Manual Hydraulic Press has been a workhorse in laboratories around the world for many years and is the central accessory of the Advanced Solids Pack; the other accessories included in this pack include everything required to produce 13mm KBr pellets.

Gas Pack: The Storm™ 10cm Pyrex gas cell is the ideal choice for measuring the infrared spectra of concentrated gases, gas mixtures and vapours (>1% levels). Also included in the Gas Pack are KBr windows, all necessary seals and a cell mount.

Quest™ ATR: The flexibility of ATR is now well known and the Specac Quest™ ATR accessory provides flexibility through its interchangeable crystal pucks with a choice of Diamond, Extended Range Diamond, ZnSe, or Ge crystals.

FT-IR Individual Application Packs

ordering information

Liquid Pack

GS01140 Liquid Pack Complete

(contents below)

GS01110 Luer Syringe 2ml
GS01800 Omni-Cell™ Assembly
GS01811 KBr Windows (Pair) for liquids
GS01812 CaF2 Windows (Pair) for liquids
GS01831 KBr Windows (Pair) for Mulls
GS01864 Assorted PTFE Spacers (10 - for liquid cells)
GS01871 PTFE 0.1mm Spacers (5 - for mull cells)
GS03620 Bottle of Nujol (25ml)
GS03621 Bottle of Fluorolube (25ml)

Basic Solid Pack

GS01150 Basic Solid Pack Complete

(contents below)

GS03940 Mini-Pellet Press (2T)
GS03950 7mm Pellet Die with Pellet Ring Holder
GS03951 7mm spare Pellet Ring Holder
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03960 7mm Disc Holder with Rectangular Mount

Advanced Solid Pack

GS01160 Advanced Solid Pack Complete

(contents below)

GS15011 15T Manual Hydraulic Press
GS03600 Pestle and Mortar
GS03610 KBr Powder (50g)
GS03410 13mm Disc Holder with Rectangular Mount
GS03000 13mm Evacuable Pellet Die

Gas Pack

GS01170 Gas Pack Complete

(contents below)

GS05021 KBr Windows (Pair)
GS05030 Storm 10cm Cell Mount
GS05000 Storm 10cm Pyrex Gas Cell (Body Only)
GS05040 Storm 10cm Complete Seal Kit

Quest™ ATR ZnSe

GS10802 Quest™ ATR Single Reflection ATR with ZnSe Flat Crystal Top Plate

Accurate leather analysis

SPECAC APPLICATION NOTE

Animal skins have been used to make leather since ancient times and the texture and properties depend on which animal they come from.

Chemical treatment with vegetable tannins modifies the skins to produce strong and flexible materials that resist decay and commercially, IR spectroscopy is used to test for consistency in batches of leather and to uncover fraud.

Attenuated Total Reflectance (ATR) accessories like the Quest™ allow users to test a variety of leathers quickly and efficiently.

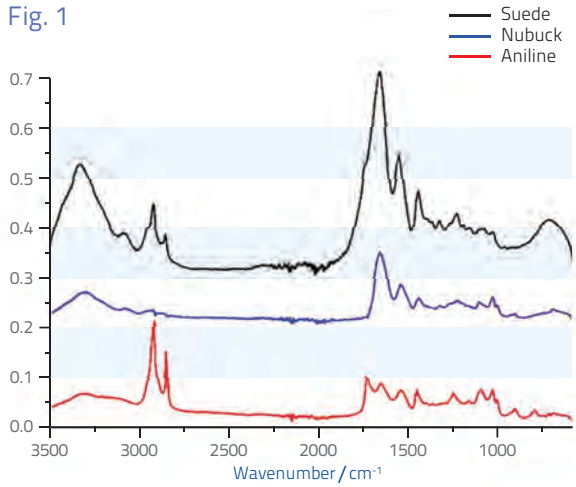
This application note shows how ATR spectroscopy can be a fast and reliable technique to distinguish different leathers.

Fig.1 shows the IR spectra of three material samples of nubuck, suede and aniline-dyed leather recorded using the Quest™ ATR accessory in a commercially available spectrometer.

The spectra were recorded by simply placing the leathers onto the ATR device for 20 seconds. Therefore, the turnover for sample analysis is significantly faster than traditional solid analysis methods.

Suede is primarily made from the lambskin, while nubuck is a cowhide leather made to feel like suede. Aniline leather is a leather made with soluble dyes that cover the material surface. The chemical makeup of all three samples is different and as such, their IR spectra are different.

Fig. 1



If we focus on the lower wavenumber region of 1800-600 cm^{-1}, we can see the amide I and II band intensities differ for each material.

Therefore, the ATR technique allows for a fast and effective distinction of a large number of different samples.

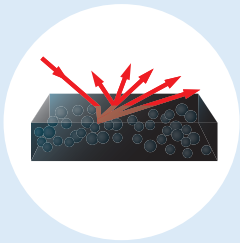
CONCLUSION

IR spectroscopy allows users to assess the quality of fabrics in a reliable, consistent and fast way, without contaminating or damaging the material.

No sample preparation or solvents are needed for sample analysis, unlike alternative analytical techniques.

ATR-FTIR is the best spectroscopic method for reliable at-line analysis, providing manufacturing control and supply-chain checks. Complementary methods of analysis for more in depth studies on material adulteration and for the detection of fraud include SEM, as well as microscope surface mapping for quality control purposes.

Infrared Reflectance Spectroscopy



A complete and comprehensive range

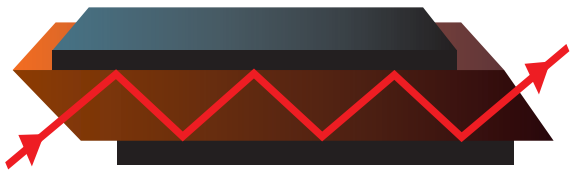
A comprehensive range of FT-IR Accessories are available for a variety of infrared spectroscopic sampling techniques. These products include: ATR Accessories, Diffuse Reflectance and Specular Reflectance Accessories, Liquid and Gas Transmission Cells, Infrared Windows, FT-IR Sampling Kits, FT-IR Consumables, and other spectroscopic accessories for FT-IR spectrometers.

IR Reflectance Spectroscopy introduction

Infrared reflectance spectroscopy is used for samples that are difficult to analyse by transmission. An advantage of many reflectance techniques is that the samples can usually be analysed without any preparation.

1. Internal Reflectance

- measurements: made using an (ATR) Attenuated Total Reflectance element in contact with the sample



Internal reflection occurs when infrared radiation enters an ATR crystal made of a highly refractive infrared transmitting material. ATR crystals are designed to enable total internal reflection creating an evanescent wave at the crystal surface.

This wave extends into a sample held in intimate contact with the crystal and absorption spectra can be recorded as a result. The depth of penetration of the evanescent wave into the sample is a function of the crystal material and the angle of incidence.

Deeper penetration is achieved with either a smaller incidence angle or a lower refractive index crystal. The depth of penetration also increases with the wavelength.

2. External Reflectance

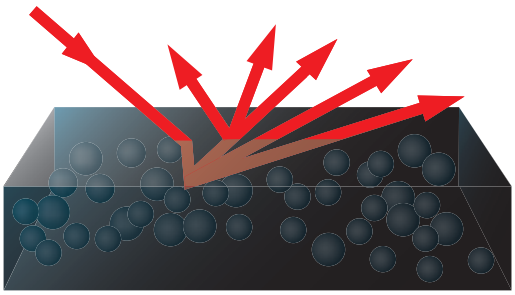
- measurements: made by collecting the infrared beam reflected from the sample surface.

In external reflectance, incident radiation is focused directly on to the surface of a sample.

The light reflected from the sample may be scattered in different directions or reflected directly, depending upon the physical form of the sample. When reflected light is scattered by the sample it is called diffuse reflection. When it is reflected directly, it is called specular reflection.

Diffuse Reflectance

In diffuse reflection infrared spectroscopy (DRIFTS) diffusely scattered light can be collected either directly from a sample, or from an abrasive sampling pad previously abraded against an intractable sample. Many samples will give diffuse reflectance spectra.



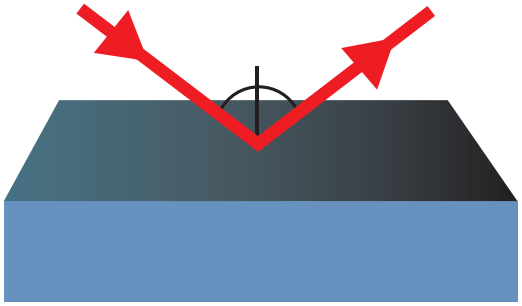
These include powders, fibres or matt surfaced samples such as textiles.

Where samples have a rough surface, such as a powder, specularly reflected light is a minor contributor to the overall signal. Specac diffuse reflection accessories are optimized to increase collection of the diffuse reflectance and decrease the specular component, as the specular component may adversely affect the spectrum.

Specular Reflectance

Specular reflectance is a nondestructive method for surface measurements using the mirror-like reflection from the shiny surface of a sample.

Specular reflectance occurs when the reflected angle of infrared radiation equals the angle of incidence.



The amount of light reflected depends on the angle of incidence, and the refractive index, surface roughness, and absorption properties of the sample. Specular reflection accessories for infrared spectroscopy are used typically to measure coatings on reflective surfaces. This type of measurement is actually a transmission measurement of the coating, rather than a specular reflection measurement from the front surface. Typical applications include the study of surface coatings on surface treated, painted, or polymer coated metals.

Increased pathlengths through thin coatings can be achieved by increasing the angle of incidence.

The maximum sensitivity is achieved at the grazing angle (80°- 85°). Monolayer films at a liquid-air interface can be studied using a grazing angle of incidence. Thicker coatings, in the micrometre thickness range, are studied typically using angles of 30°. Band intensities of the spectra also depend on the type and degree of polarization as well as the effective pathlength.

The Specac range of reflectance accessories includes both fixed and variable incidence angle accessories.

Polymer sample preparation

SPECAC APPLICATION NOTE

Techniques for infrared analysis using the Constant Thickness Film Maker.

Many industries incorporate plastics and polymers in their manufacturing processes. The need to analyse these materials either in raw state or as finished products is paramount importance in reducing production costs and optimising product quality. Currently, infrared analysis is one of the most commonly used analytical techniques employed in the evaluation of polymers and plastics, though there are some sample types which pose sampling difficulties.

The Constant Thickness Film Maker and temperature controlled Heated Platens provide a convenient and

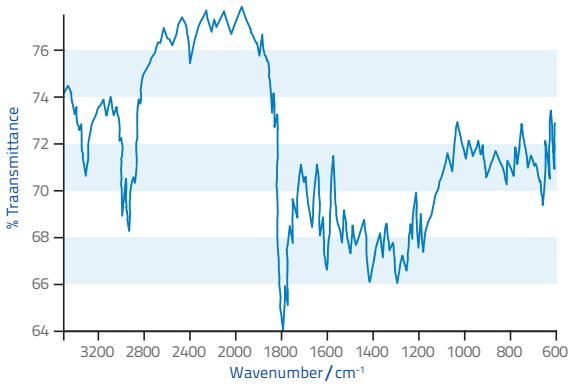
precise means of hot pressing plastic and polymer samples for quantitative analysis. This application note describes a solution to problems associated with sample adhesion and shrinkage after hot pressing of a polyurethane rubber.

Experiment

Successive trial pressings of different weights of the polyurethane rubber sample were made to determine the sample quantity necessary to avoid excessive overflow into the CTFM sample indentation area. Avoidance of sample overload, in this case, eliminates intractable adhesion problems to the CTFM metal surfaces. The polyurethane rubber sample (about 0.6g) was sandwiched between two aluminium foils in the CTFM accessory using a 25 micron spacer ring. The sample was pressed at 155°C under 3 ton pressure for 2 minutes in a water cooled heated platens/hydraulic press assembly. The heating was then switched off and the sample left to cool, under pressure, to 45°C. Time for the complete heat cycle was about 12 minutes.

The aluminium foil on the circumference of the sample overflow was gently scrapped off on one side only using a scalpel. The exposed polymer film edge was backed onto a 32mm i.d. x 3mm thick nylon 66 supporting ring (Specac P/N GS03805) and the assembly pressed again directly between the heated platens at about 140°C and 3 ton pressure.

The heated platen surfaces were protected with extra aluminium foils backed on either side of the sample/retaining ring assembly to prevent any part of the polymer being directly in contact with the platen surfaces. After peeling off the second layer of aluminium foils. The film was removed with a pair of tweezers, washed several times with distilled water and allowed to dry in a current of warm air.



CONCLUSION

Polymer samples which are more difficult to analyse quantitatively due to film adhesion and shrinkage during sample preparation can be conveniently handled by the CTFM using a ring support and chemical dissolution of the aluminum foil. This procedure further extends the capability of the CTFM from easy to use cross linkage and unreactive polymer samples to long chain polymers with highly reactive surface groups or high elasticity.

Attenuated Total Reflectance Accessories

Page 22
Quest™ ATR

Page 24
Golden Gate® ATR

Page 32
Gateway™ ATR

Page 35
25 Reflection ATR

A high performance range of accessories

Specac offers a comprehensive range of Attenuated Total Reflectance (ATR) accessories for the analysis of solids, liquids, pastes, and gels.

These ATR accessories are compatible with a range of FT-IR spectrometers, and options are available for heated, cooled, or other advanced material analysis.

The product range includes the high-performance Golden Gate single reflection diamond ATR accessory and innovative Quest™ ATR accessory.

Quest™ Single Reflection ATR

The most significant innovation in infrared spectroscopy in the last 10 years, designed for laboratory spectroscopic sample analysis in the mid- and far-infrared.

Quest™ Single Reflection ATR

The Quest™ ATR Accessory is a performance single reflection ATR accessory from Specac designed for laboratory spectroscopic sample analysis in the mid- and far-infrared.

With innovative optical design and durable monolithic diamond ATR crystal option, this sets the benchmark in performance and value for ATR spectroscopy.

In its standard configuration, the Quest™ ATR Accessory has a strong and durable monolithic diamond ATR crystal which is ideal for analysing hard inflexible solid materials without risk of being scratched or damaged even for extreme point loads.

Coupled with diamond's inherent chemical resilience, this allows the Quest™ ATR Accessory to be used with the broadest range of sample types. A 1.8mm diameter diamond sample area means that good contact can be achieved even with the smallest amount of material available for analysis.

The Quest™ ATR Accessory features an all-reflective optical design, based around Specac's proprietary Synopti-Focal Array technology.

This comprises precision-moulded aspheric mirrors and gold-coated optics as standard, and provides the Quest™ ATR Accessory with high transmission throughput and an extended wavelength range capability to match that of your mid- and far-infrared FT-IR instrument.

Together with an optimised angle of incidence on the ATR crystal, these features ensure outstanding quality of spectra.

Key features

- Strong and durable monolithic diamond
- Extended wavelength capability from 10,000 to 40 wavenumbers
- High spectral quality and high throughput capability
- Interchangeable Diamond, ZnSe & Ge crystal puck options

Four easily-interchangeable crystal pucks are available for use with the Quest™ ATR Accessory: a high-throughput diamond puck for mid-infrared analysis (7800 to 400cm^{-1}), an extended wavelength range diamond puck for the mid- and far-infrared (10000 to 40cm^{-1}), a ZnSe crystal puck for softer materials, and a Ge crystal puck for strongly absorbing samples. These ATR crystal are mounted in a durable stainless steel puck and held in place against a robust metal seal to ensure compatibility with a broad range of sample types.
Repeatable and reproducible sample loads are enabled by a full-function pressure tower. This has an audible 'click to indicate at the preset pressure limit, and features a swing anvil arm to allow easy access to the ATR crystal puck.

Both plane and pellet anvils are provides with the accessory to allow analysis of samples of various shapes. These anvils are easily interchangeable and stored on the top plate when not in use.

(Note: Quest™ ATR accessory is Benchmark™ Baseplate compatible - see next page)

Quest™ Single Reflection ATR

The Benchmark™ Baseplate System

Specac believe that your accessory should be able to be quickly and easily switched from instrument to instrument in your laboratory.

To facilitate this we have developed the Benchmark™ Baseplate system as an interface between the accessory and instrument, and to which the accessory can be fitted with a single thumbscrew fixing. The Benchmark™ Baseplate is unique to the instrument model being used (a baseplate is supplied with the Quest™ ATR accessory) and can be left in the sample compartment, if required, for use with other Specac Benchmark™ compatible accessories.

Why is a monolithic diamond important?

Diamond ATR accessories on the market are generally available in two forms: those that feature a solid monolithic diamond and those with a thin diamond wafer supported by an optical element (typically ZnSe). Monolithic diamond ATR accessories are seen to benefit from the inherent robustness and durability of a solid diamond element, and are particularly resilient to high point loads typically encountered when analysing hard irregularly formed samples. They can also take advantage of the broad transmission window of diamond (10,000 to 40cm^{-1}).

Conversely, diamond wafer ATR accessories are seen to be more fragile under point loads, can suffer de-lamination from the supporting element, and have a useable transmission range that is often limited by the support material. However, featuring a thinner diamond, they also have weaker diamond absorption features at 2000 to 2500cm^{-1}.

ordering information

Quest™ ATR accessory complete

Please specify make and model of spectrometer

GS10800-X Quest™ ATR Diamond
GS10801-X Quest™ ATR Diamond-Extended Range
GS10802-X Quest™ ATR ZnSe
GS10803-X Quest™ ATR Ge

X = Top-plate colour

Please choose Top-plate colour

B = Black **O** = Orange **Y** = Yellow **P** = Purple
G = Green **R** = Red **A** = Aqua

Quest™ ATR Puck only

GS10810	Quest™ ATR Diamond Crystal Puck
GS10811	Quest™ ATR Diamond Extended Range Crystal Puck
GS10812	Quest™ ATR ZnSe Crystal Puck
GS10813	Quest™ ATR Ge Crystal Puck
GS10816	Quest™ ATR Specular Refelectance Puck
GS10819	Quest™ ATR Si Crystal Puck

Spares and accessories

GS10820	Quest™ ATR Stainless Steel Flat Anvil
GS10821	Quest™ ATR Stainless Steel Pellet Anvil
GS10825	Quest™ ATR Volatiles Cover
GS10707	Purge bellows (pair)

Golden Gate® Single Reflection Diamond ATR Series MkII

The Golden Gate® is the world's most versatile infrared sampling system. It analyzes all types of samples, from hard solids to corrosive liquids, and it is easy to use, sensitive and robust.

Golden Gate® Diamond ATR

Outstanding sensitivity is achieved using high pressure contact against a solid, single crystal diamond, selected for its unparalleled sensitivity as a single reflection ATR element together with its unique physical and chemical stability.

The accessory can be used to analyze a range of samples from single particles and fibres to corrosive liquids. While the large working area sample platform is ideal for macro sampling.

The diamond is high temperature bonded into its tungsten carbide mount, giving performance and strength to withstand the high pressures required for maximum optical contact with hard samples.

The quick lock and release bridge allows for fast sample change around. The built-in pressure control mechanism means reproducible results are obtainable and optimum sample clamping is achieved.

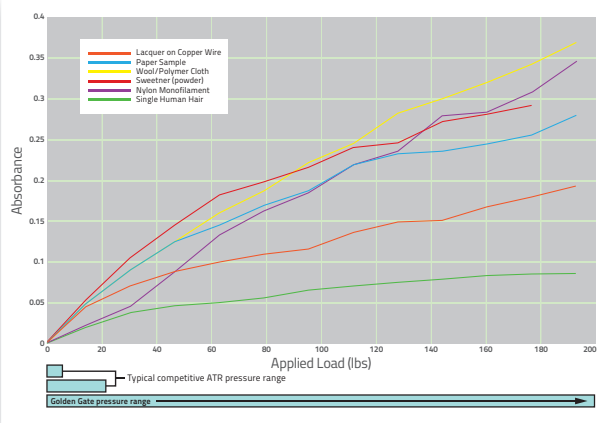
Polarization studies can be carried out using the Benchmark™ polarizer mount (GS12510 - see p104)

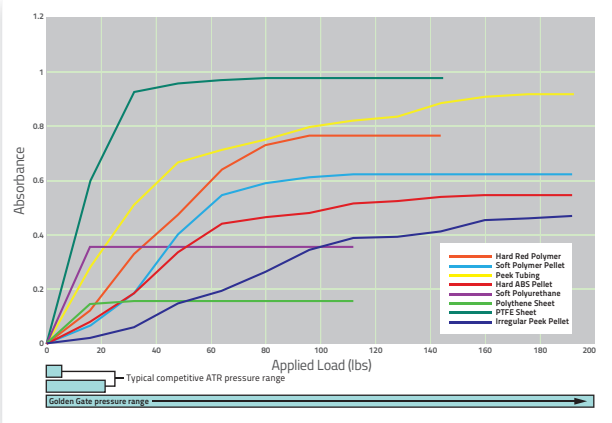
Key features

- High sample throughput - no preparation
- Rugged single crystal diamond ATR metal-bonded into a tungsten carbide mount
- Hard, inert, sapphire self-levelling pressure anvil
- Pressure bridge for highest sensitivity
- A wide choice of available options
- Quick release bridge with safety interlock
- Built-in pressure control for reproducible results

Applications

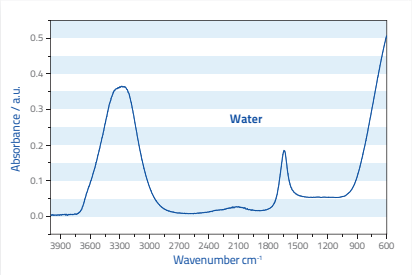
- QA on pharmaceutical powders
- Analysis of hard and soft polymer pellets
- Forensic sampling, paint chips and single fibres
- Hard samples, e.g. rock and geochemicals
- Corrosive liquids
- Coated wires
- Air sensitive samples

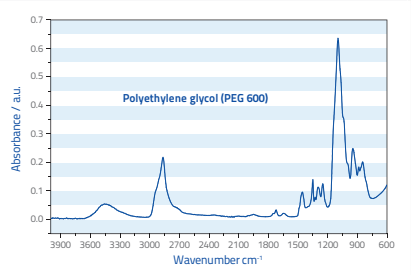


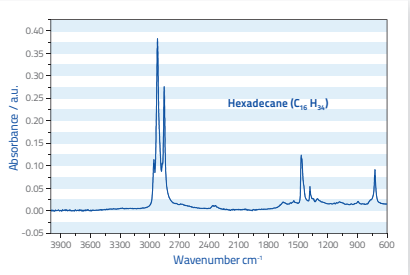


The effect of load on ATR sensitivity

Measurements for typical samples







Ultimate sensitivity and reproducibility

A key feature of the Golden Gate® Single Reflection ATR System is the outstanding contact achievable between solid samples and the diamond crystal.

For many sample types (particularly powders and fibres), as the load is applied to the sample and optical contact between the diamond and the sample increases, the intensity of the absorbance bands also increase. In other words, increasing the load increases the sensitivity.

The Golden Gate® gives the highest load capability of any commercial diamond ATR (over 180 lbs) and the diagrams above illustrate how that impacts sensitivity for a variety of sample types.

For softer samples, such as polymers, a similar effect is seen. However, once the sample has fully contacted the ATR surface, the absorbance stops increasing with increasing pressure.

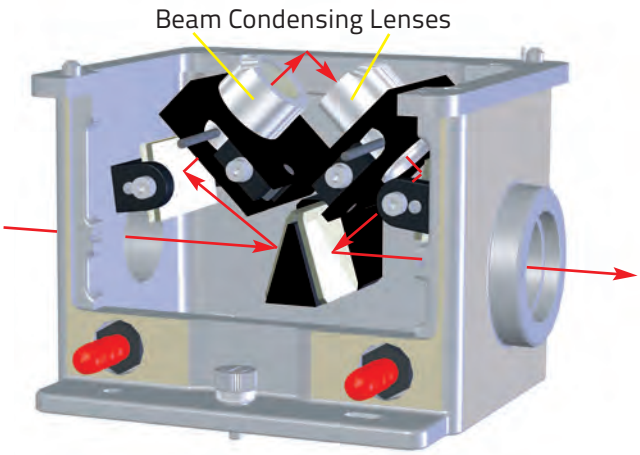
In order to achieve the best measurement repeatability and reproducibility for these samples, the instrument should ideally apply a load above the "knee" of the curve where the absorbance becomes much less sensitive to load.

The diagrams above illustrate some measurements for typical samples. Note how the harder sample types need a higher load to reach this ideal situation - and very often the Golden Gate® is the only product that can do it.

Golden Gate® Single Reflection ATR

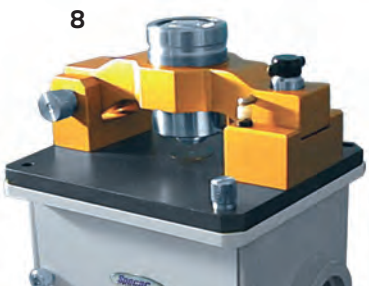
Top-plates of the Golden Gate® Single Reflection ATR Series are supplied on an optical unit which contains mirrors and a choice of beam condensing optics (ZnSe or KRS-5). All Top-plates are interchangeable with the optical unit.

A schematic is shown opposite of the beam path through the Golden Gate® optical system. The symmetrical design coupled with the use of the Benchmark™ base-plate system means that the Golden Gate® can be used in most commercially available FT-IR instruments.



Golden Gate® Anvil options

A variety of special anvils are available for use with the Golden Gate® Top-plates. The use of an appropriate anvil improves the sample handling capabilities of the Golden Gate® Single Reflection ATR System.



1 Reactive Sample Anvil

Samples which are sensitive to air or moisture can be loaded and pressed in a dry box. The anvil has a seal which compresses as the sample is pressed, thus keeping it in an inert environment while the spectrum is being run.

2 & 5 Grooved Anvils

(Narrow and Wide) To study the coating on transformer wire the grooved anvils hold the wire exactly in the middle of the diamond.

3 Sapphire Anvil

This is the standard anvil and is used for most sample types. It has the advantage of being very hard, and easy to clean to prevent sample carryover. It is also self-leveling to accommodate non flat samples.

4 Stainless Steel Flat Anvil

This is used for fibres or fine wires. It is not self-levelling, which can be an advantage with this type of sample.

6 Pellet Anvil

Polymer pellets are held firmly in position with this concave anvil. With a flat anvil they could move when pressure is applied.

7 Volatiles Cover

If liquid samples are very volatile the cover is useful to minimize evaporation.

8 View-Thru Anvil

The View-Thru Anvil allows the sample to be viewed through a 4x lens system with a built-in reflective illuminator.

9 Flow-Thru Anvil

This micro flow cell anvil seals under pressure around the diamond. Its volume is 28 microliters and it can operate at 1000 psi. It may be used as a flow cell or as a micro reaction chamber.

Golden Gate® Top-plate options

High Temperature Top-plate

P/N GS10640

Many reactions and processes occur at high temperatures. The Heated Diamond Top-plate includes all the normal features of the Golden Gate® sampling technique but with the added benefit of heating samples up to 300°C. Diamond has a uniquely high thermal conductivity.

The Top-plate has a low thermal mass, and in combination with high power heaters in close proximity to the diamond, both rapid and efficient heating is achieved. This gives a high degree of temperature control. A rapid sample turn around is therefore possible. The Top-plate can be used with a computer controlled temperature controller with digital readout to 1°C. With safety in mind, low voltage (30V) heaters are used, and for additional protection thermal fuses are fitted as standard. The controller complies with European CE regulations.

Key features

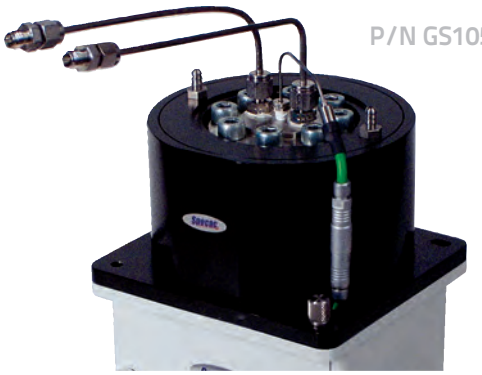
- Heatable to 300°C
- Diamond in tungsten carbide mount
- Low voltage heaters
- Thermal safety fuses
- Programmable temperature control via optional RS232, RS485 or USB connection
- Complies with CE regulations
- Low thermal mass
- Thermal safety fuses

Applications

- Polymerization studies
- Thermochemical studies
- Curing reactions
- Degradation / decomposition

Reaction Cell

P/N GS10507



The Reaction Cell allows in-compartment reaction monitoring over a broad range of extreme conditions. The diamond is metal bonded into a tungsten carbide mount and this is contained within a high pressure reaction vessel.

The unique strength and durability of the diamond element makes it ideal for withstanding combinations of aggressive chemical contact at high temperatures and pressures.

Key features

- Controlled temperatures to 200°C
- Low voltage (30V)
- Cell volume 28ml
- Pressures up to 3000psi
- Water jacket to prevent overheating
- Stainless steel construction with a choice of other materials
- Stirring option available (contact Specac)
- Flow through configuration option

Applications

- Chemical reaction analysis at high temperatures and pressures
- Caustic solutions
- Slurries with abrasive particulates
- Acidic reactions
- Optimization of process parameters

Golden Gate® Top-plate options cont'd

Low Temperature Top-plate

P/N GS10590

The Golden Gate® low temperature diamond ATR system is the first ATR accessory to provide high performance ATR measurements down to near liquid nitrogen temperature. The system uses a thermally insulated copper and stainless steel dewar in conjunction with an integral heater

The high thermal conductivity of the diamond crystal provides rapid temperature stabilization, accurate temperature measurement, and avoids temperature gradients across the sample.

The diamond ATR crystal is high temperature metal bonded into a tungsten carbide support disk and the top plate is hard-anodized to make the accessory chemically resistant and capable of withstanding the pressures required for optimum crystal and sample contact. Pressure is applied to the sample using the quick lock and release bridge from the proven Golden Gate® diamond ATR system.

Key features

- Continuous control of sample temperature from -150°C to 80°C
- High thermal conductivity provides rapid cooling and temperature stabilization
- Proven, strong clamping device, based on the
- Golden Gate® Diamond ATR, allows rapid, reproducible sample throughput
- Thermally insulated copper and stainless steel dewar allows for the use of liquid nitrogen, dry ice, or salt & water refrigerant mixtures

This clamping device allows rapid sample throughput and reproducible solid sampling.

It also has a built-in torque limiter to control the loads applied to the diamond.

The Golden Gate® low temperature diamond ATR is constructed in such a way that the crystal mounting is under a constant load. This ensures that the diamond is kept in constant optical alignment, negating the effects of thermal expansion and contraction.

The upper thermal dewar body of the system is separated from the top-plate by a replaceable, thermally conducting spacer, avoiding the need for use of sealants that may contaminate the diamond surface. The system is easily and quickly taken apart for cleaning.

Micro Specular Reflectance Top-plate

P/N GS10514

Applications

- Micro reflectance samples
- Very highly absorbing samples
- Carbon black containing polymers

A 45° angle Micro Specular Reflection Top-plate is for flat samples of greater than 3mm x 6mm, or powders that can be pressed into a self-supporting wafer. A scribed reference grid allows accurate repeat positioning of samples.

Golden Gate® Top-plate options cont'd

Supercritical Fluids Top-plate

P/N GS10585

Key features

- Pressures up to 6000 psi
- Temperature controlled to 300°C
- Low volume 28µl stainless steel sample cell
- Standard 1/16th inch fittings
- CE Marked

Applications

- Supercritical and near supercritical fluids
- Extreme condition analysis of polymers
- In-situ ATR studies at high temperatures and pressure

The Supercritical Fluids Analyzer version of the Golden Gate® Diamond ATR is designed for operation at extreme temperatures and pressures.

The diamond ATR element is high temperature metal bonded into a tungsten carbide disk, avoiding the use of adhesives or resins that may be dissolved or attacked by the chemical aggressiveness of supercritical fluids.

The sample chamber has been specially constructed using stainless steel and is capable of withstanding pressures up to 6000 psi and temperatures up to 300°C. The high thermal conductivity of the diamond element is ideal for fast temperature equilibrium and accurate temperature measurement, reducing analysis time and increasing sample throughput.

The analyzer is equipped with a thermal protection system to prevent thermal runaway.

Golden Gate®

ordering information

Golden Gate® ATR Mk II series

A complete Golden Gate® ATR Mk II System consists of an Optics Unit with ZnSe or KRS-5 Lenses, Top-plate (GS10563), Baseplate and Purge Bellows.

GS10500 **Complete Golden Gate® ATR Mk II** with ZnSe Lenses

GS10515 **Complete Golden Gate® ATR Mk II** with KRS-5 Lenses

(A Golden Gate® top-plate can be provided as a complete accessory on a ZnSe or KRS-5 lens optical unit or as an upgrade additional top-plate)

(Please specify make and model of spectrometer)

Top-plate options

GS10563 **Diamond ATR Top-plate Mk II** Including Sapphire, Pellet anvils, and Volatiles cover

GS10566 **Germanium ATR Top-plate Mk II** Including Large stainless steel anvil and Volatiles cover

GS10514 **Micro Specular Reflectance Top-plate** including Reference mirror

GS10507 **In-Situ Reaction Cell Top Plate** including Temperature controller (Specify 220V or 110V and country for controller)

GS10513 **Stirring option for Reaction Cell**

GS10585 **Supercritical fluids top-plate** including Temperature controller (Specify 220V or 110V and country for controller)

GS10590 **Low Temperature Diamond ATR Top-plate** including Temperature controller (Specify 220V or 110V and country for controller)

GS10640 **High Temperature Top-plate** Including Sapphire and Pellet anvils, Volatiles cover & Temp. controller (Specify 220V or 110V and country for controller)

Accessory options

GS10642 **High Temp. Golden Gate® ATR Mk II**

A complete heatable Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Heated Top-plate, Baseplate, Purge Bellows and Temperature Controller
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)

GS10586 **Supercritical Golden Gate® ATR MK II**

A complete Supercritical fluids Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Supercritical fluids top-plate, Baseplate, Purge Bellows and Temperature Controller
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)

GS10592 **Low Temperature Golden Gate® ATR MK II**

A complete Low Temperature Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Low Temperature top-plate, Baseplate, Purge Bellows and Temperature Controller.
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)

GS10525 **Reaction Cell Golden Gate® ATR MK II**

A complete Reaction Cell Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Reaction Cell Top-plate, Baseplate, Purge Bellows and Temperature Controller
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)

GS10513 **Stirring option for Reaction Cell**

Ask Specac for full details

Golden Gate®

ordering information

Upgrade - lenses

GS10552 **ZnSe lens upgrade kit** 6500 - 600cm^{-1}

GS10508 **KRS-5 lens upgrade kit** 6500 - 400cm^{-1}

Anvil options - Golden Gate® ATR Mk II

Top-plates

GS10503 **Volatiles Cover**

GS10531 **Sapphire Anvil**

GS10532 **Pellet Anvil**

GS10536 **Reactive sample Anvil**

GS10547 **Grooved Anvil** - narrow gauge

GS10548 **Grooved Anvil** - wide gauge

GS10549 **Stainless steel flat Anvil**

GS10567 **Stainless steel large Anvil** for Germanium Top-plate

GS10568 **Micro Reaction/Flow Cell Anvil**

GS10569 **View-Thru Anvil/Bridge assembly**

Spares

GS10707 **Purge bellows**

GS10550 **Golden Gate® ATR Accessories ESK**

GS10527 **Golden Gate® Microspecular ATR ESK**

GS10528 **Golden Gate® Reaction Cell ATR ESK**

GS10529 **Golden Gate® SCF ATR ESK**

Options

GS28000 **RS232 Connection kit**

GS28001 **USB Connection kit**

GS28002 **RS485 Connection kit**

GS12510 **Benchmark™ polarizer mount**

Gateway™ ATR System

An advanced 6 reflection ATR system for the infrared analysis of solids, liquids, pastes and gels.

Gateway™ ATR System

The Specac Gateway™ ATR system is a low cost multi-reflection horizontal ATR accessory.

High performance transfer optics and anti-reflection coated ZnSe crystals ensures unrivalled throughput and sampling sensitivity.

The rugged design, simple optical layout and Specac's unique Benchmark™ base-plate system ensures optimum performance no matter which instrument make or model you use. The standard dual top plate configuration offers the most versatile package while optional, additional top plates allow sampling flexibility and system expandability.

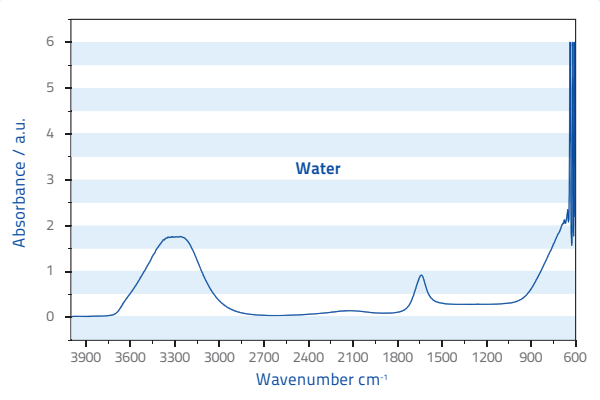
For the study of samples at elevated temperatures up to 200°C, there is an additional option of the electrically heated trough top plate with 45° angle ZnSe crystal and dedicated temperature controller P/N GS11155. The plate is an open trough design similar to the standard trough top plate P/N GS11166, whereby a liquid is simply poured in to cover the crystal.

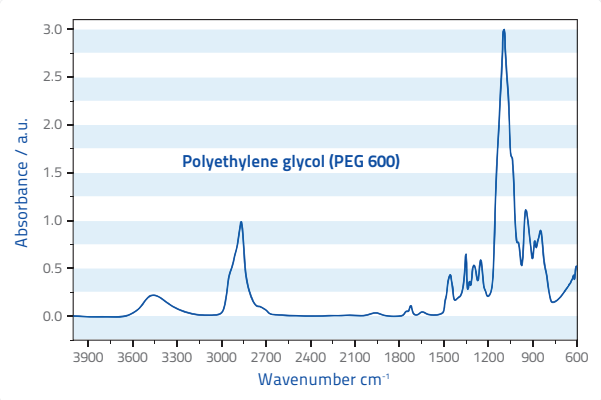
Key features

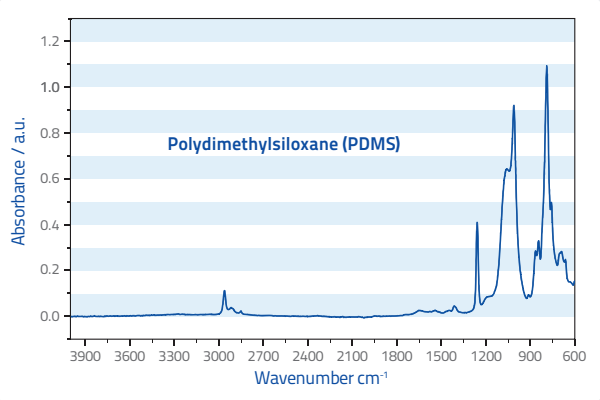
- Replaceable crystals ZnSe, Ge and Si options
- High optical throughput
- Purgeable optics
- Extensive range of optional top plates
- Benchmark™ base-plate system

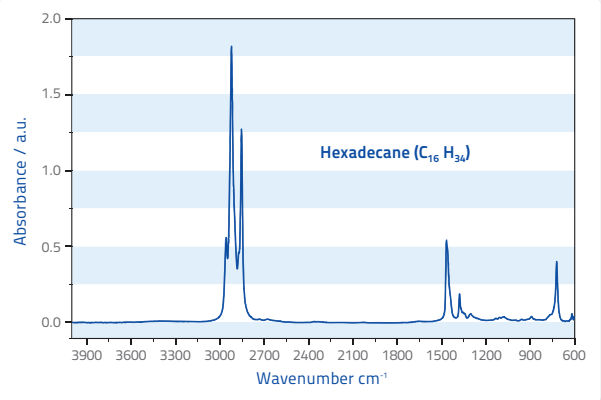
Applications

- Aqueous solutions
- Liquids – static or flowing
- Pastes and gels
- Polymer films
- Fine powders
- Quality control
- Temperature sensitive samples
- Reaction kinetics
- Education









Measurements for typical samples

The thermostabilised open trough top plate P/N GS11139 is similar to the P/N GS11155 top plate, but relies on a thermocirculating fluid for heating rather than from an electrically powered temperature controller.

An alternative type of heatable top plate for Gateway ATR is the 550 microliter thermostabilized flow through top plate assembly with 45° angle ZnSe crystal P/N GS11118.

A liquid sample can be flowed across the sampling surface of a ZnSe crystal in an enclosed chamber. The outer casing can be heated by the flow of a thermocirculating solution surrounding the sample/crystal area. The temperature achievable is dependent upon the thermocirculating fluid being used i.e. water or oil, etc.

A liquid sample pumping system can be used for delivery of the liquid sample via peristaltic type flow through flexible tubing attached to the sample ports on the flow plate. The sample flow through the thermostabilized flow through top plate is rated up to a 60psi maximum.

There is also a room temperature flowthrough top plate version with 550µl volume P/N GS11116.

All of the Gateway ATR top plates are supplied with a 45° angle ZnSe crystal P/N GS11145, but alternative germanium P/N GS11147 and silicon P/N GS11146 crystals at a 45° angle are also available. They can be supplied on their own for placement into the trough or thermostabilized top plates, but they must be pre-affixed into a flat top plate assembly.

Gateway™ ATR Top-plate options

ordering information

GS11165 **Gateway™ ATR System** including optics unit, Benchmark™ Base-plate, ZnSe trough and flat top plates, sample clamp, purge bellows

Other options

GS11132 **Volatiles Cover**
GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**

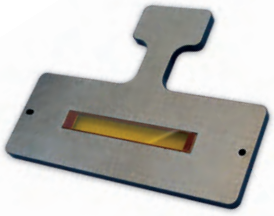
Spares and consumables

GS10707 **Pair of Purge Bellows** for enclosing Benchmark™ ATR beam path in spectrometer sampling compartment
GS11129 **Gasket Replacement Kit** for GS11130, GS11139 and GS11155 Top-plates
GS11152 **Flow Through Top-plate** silicone tubing
GS11133 **ZnSe Flat Top-plate**
GS11134 **Si Flat Top-plate**
GS11135 **Ge Flat Top-plate**
GS11145 **Replacement ZnSe Crystal** for all Top-plates (except Flat GS11133)
GS11146 **Replacement Si Crystal** for all Top-plates (except Flat GS11133)
GS11147 **Replacement Ge Crystal** for all Top-plates (except Flat GS11133)
GS11150 **Kalrez Gaskets** for GS11116 and GS 11118 Top-plates
GS11167 **Isolast Gasket set** for trough Top-plate GS11166
GS11170 **Gateway™ optics unit** only
GS11171 **Sample Clamp**

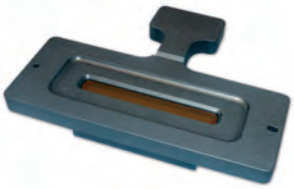
(Other crystal materials available on request)

Optional Top-plates

GS11133 **Flat Top-plate**
Ideal for solids or films
Variety of crystals available



GS11166 **Trough Top-plate**
Ideal for liquids and pastes
Removable crystal
Variety of crystals available



GS11116 **Flow thru Top-plate**
Process control
550µl volume
Removable crystal
Variety of crystals available
Reaction monitoring

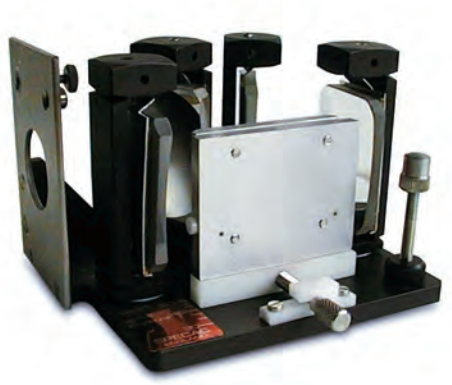
GS11118 **Thermostabilized Top-plate**
Reaction kinetics
550µl volume
Heatable to 90°C
Removable crystal
Stainless steel top-plate and Kalrez spacer

GS11139 **Water heated trough Top-plate**
A sub ambient to 90°C Top-plate heated or cooled by thermocirculating fluid

GS11155 **Electrically heated trough Top-plate**
An electrically heated top-plate with dedicated temperature controller.
This top-plate is heatable to 200°C.
(Specify 220V or 110V)

25 Reflection ATR

For high sensitivity ATR measurements with FT-IR or dispersive instruments.



Key features

- Variable angle of incidence (30° - 60°)
- 25 Reflections
- Suitable for both FT-IR and dispersive instruments
- Two pin sample location on sample mount
- Standard 3" x 2" slide mounting
- Choice of crystal materials; KRS-5 as standard
- Interchangeable sample holders (solids, liquids and pastes)

Applications

- Solids
- Liquids
- Pastes
- Variable depth studies for coatings and films

25 Reflection ATR

The 25 Reflection Variable Incidence ATR (P/N GS11000) is a vertically mounted ATR crystal accessory capable of being operated for a crystal incidence angle of between 30° to 60°. The angle of incidence for the crystal is quickly and easily selected by rotation of a knurled adjustment screw. This moves the sample holder and crystal assembly to the correct position when the back face of the holder is in line with the required angle setting as indicated on the graduated plate.

The standard crystal holder (P/N GS11001) supplied with the ATR Accessory is for solid samples, but a liquids holder (P/N GS11003) and a paste holder (P/N GS11002) are available on request. Although the sample holder and crystal assembly can be positioned between the angles of 30° to 60°, it is only when the holder and crystal assembly are correctly aligned at the 45° angle, that 25 internal reflections are obtained within the crystal. Sufficient sample is required to cover both faces of the trapezium shaped crystal for 25 reflection events to be measured.

The ATR Accessory is supplied with a KRS-5 crystal as standard, but a variety of crystal materials such as ZnSe, Ge and Si are available to extend the sample handling and study capabilities of the accessory.

The IR beam is directed through and collected from the crystal by four mirrors which are adjustable for both their rotation and tilt.

The accessory is supplied with a standard 3" x 2" mounting plate that allows it to be positioned in the spectrometer sample compartment using the instruments own 3" x 2" mounting baseplate.

In addition, the accessory is supplied with a support foot that is used in one corner of the base. The foot is adjustable for height to provide mechanical stability of the accessory whilst in the sample compartment. A thumb nut locks the foot in position.

ordering information

GS11000 **25 Reflection Variable Incidence Angle ATR** includes Solids holder and KRS-5 crystal (45°)

Options

GS11001 **Solids holder for 25 Reflection ATR**
GS11002 **Paste holder for 25 Reflection ATR**
GS11003 **Liquid holder for 25 Reflection ATR**

Spares and Consumables

GS11004 **KRS-5 crystal** (45°)
GS11006 **Ge crystal** (45°)
GS11009 **Si crystal** (45°)
GS11014 **ZnSe crystal** (45°)
GS11008 **PTFE gaskets** (1 large, 1 small) for liquid holder (5 sets)

Adhesion properties of inks

SPECAC APPLICATION NOTE

The ink industry has responded extremely well to the changes within the print industry, supplying an exciting complexity of shades and types of inks to match the variations of printing processes.

Printed defects on plastic film packs which detract from customer appeal can be eliminated by careful fabrication of ink and treated films.

The use of a Specac hydraulic press and heated platens with automatic temperature controller enables simulation of life time storage conditions to be carried out on printed film. The flexographic printing process is commonly used for film printing because it is quick and relative cheap in terms of design changeover.

Experiment

A commercially pretreated polyethylene film was used in this experiment. The treatment process normally involves treating one side of the film with additives (eg. polyvinyl dichloride or acrylic coating) and further subjecting it to high voltage corona discharge treatment to make the coated face receptive to ink bonding. Four 18 inch lengths by 2 inch wide pieces of the flexographically printed film were cut and rolled up around a former (eg. pencil) with ink against the untreated surface and the former removed. The four rolled pieces were placed evenly on the heated platens and a pressure of 5 tons was exerted by the hydraulic press for 2 hours at room temperature (it is important to use at least four rolled pieces to ensure an even pressure across the platens and samples). On removal, one sample was unrolled and checked for blocking, another one was tested 1 hour later after the sample had undergone "relaxation". The experiment was repeated with 6 and 7 ton pressures.

Polyethylene which was treated on both sides was used with the same experimental conditions as before, so that the printed side was rolled up with the ink against a treated back surface.

The ink block test is currently the most reliable and accurate method of simulating conditions of heat and pressure which printed films (20-50 microns thick) undergo during storage in various climatic conditions. The previous know methods of testing, using a block of weights or a spring gauge, had the disadvantage of being inaccurate, time consuming and lacking heat testing.

The tested films showed that the printing did not affect the film release either immediately or after film "relaxation". Where films are stored in large rolls for several months in different climatic conditions, the ink block test gave a good indication of the expected film behaviour with respect to ink adhesion and ink transfer properties.

CONCLUSION

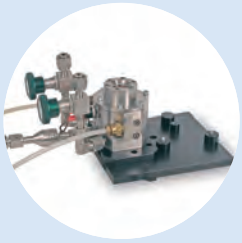
The Specac hydraulic press and heated platens with digital automatic temperature controller are ideal tools for simulating long term storage conditions on printed films. Films printed by the flexographic method will perform well in printing and packing plants in various climates. This results in enormous financial benefits.

The ink block test may also be extended to cover printing of paper by lithographic process. Other applications include investigation of the condition of books and journals stored for long periods in stacks in libraries and factories.

Diffuse Reflectance Accessories

Page 38
The Selector™

Page 39
Environmental Chamber



Page 40
Minidiff® Plus

Innovative and designed to perform

Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) accessories allow the study of the diffuse reflection from solid, powdered, and crystalline materials in the NIR and Mid-IR.

The technique allows material characterisation without recourse to extensive sample preparation. Specac provides diffuse reflectance accessories for both ambient environment and heated/pressurized environment analysis.

The Selector™

An expandable diffuse reflectance sampling system that can change with your applications.

The Selector™

Diffuse reflectance is based upon the collection of radiation that has been diffusely scattered from the sample. The Specac Selector™ uses an optimized off axis optics configuration which selectively collects the diffusely reflected components, whilst minimizing the specular component.

Various sampling cups are offered including a standard 11 mm diameter cup, a micro 4 mm diameter cup, and tilted cups. The tilted cups allow for collection of total reflectance, diffuse and specular components. In addition, an abrasive sampler, 12 mm diameter, can be used with Diabrase pads to allow quick and easy sample preparation of intractable solids.

The abrasive pad is simply rubbed against the sample of interest and mounted in The Selector™ accessory. The Selector™ is mounted on its own baseplate. The off-axis design allows room for the use of specialist alternative configurations. The Environmental Chamber option (see next page) extends the sampling capabilities of The Selector™.

Key features

- Diffuse or total reflectance capabilities
- Minimal alignment
- Easy sample handling
- Macro, micro and tilted cups
- Diabrase synthetic diamond abrasive pads
- Sampling expandability via special baseplate option

Applications

- Powders
- Intractable solids
- Liquid samples as a dispersion over KBr matrix

ordering information

GS19900 **The Selector™**
Diffuse Reflectance System includes

Optical unit with dedicated baseplate

Micro sample cup (4mm diameter)

2 Standard cups (11mm diameter)

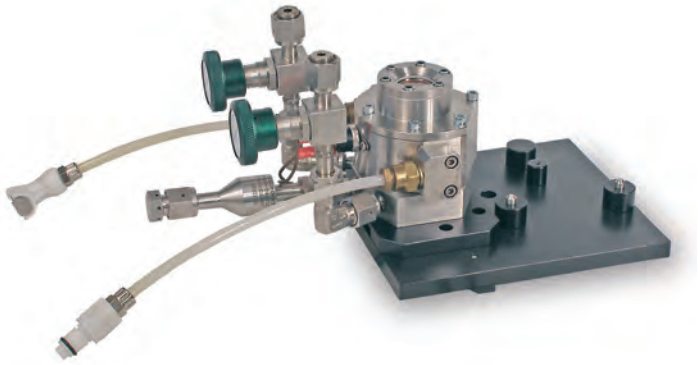
20 Diabrase abrasive sample pads (12mm diameter)

2 Mounts for abrasive sample pads

Tilted cup for total reflectance measurements

Please specify make and model of spectrometer

Environmental Chamber option for The Selector™



The Environmental Chamber, in conjunction with The Selector™, is ideal for use in chemical research.

Environmental Chamber™

This accessory allows for the study of diffusely reflecting solid samples in a controlled atmosphere ranging from ambient temperature to 800°C, and vacuum (10-3 Torr) to 500 psi pressure.

The standard chamber window is ZnSe, which gives a good balance between IR transmission and mechanical strength. Other optical transmitting windows are available on request.

The body is constructed from 316 stainless steel for ruggedness and chemical resistance.

Safety features include a low voltage automatic power supply and an automatic shut-down feature, should the temperature sensor detect an overheating fault.

A water cooling jacket keeps the outside of the chamber cool when operating at high temperatures and a safety "burst disk" activates whenever the pressure exceeds the recommended safety limit.

The Environmental Chamber, in conjunction with the Selector™, is ideal for use in chemical research such as kinetics, catalysis, surface analysis, polymerization and co-ordination chemistry.

Key features

- Programmable controlled temperatures to 800°C
- Operates from vacuum (10^{-3} Torr) to high pressure (500 psi)
- Provides controlled atmosphere (gas inlet and outlet)
- Extensive safety features

ordering information

GS19930 **Environmental Chamber** includes High Stability Controller & RS232 interface

Please specify make and model of spectrometer
Please specify 220V or 110V & country of usage

Options

GS28000 RS232 Connection kit
GS28001 USB Connection kit
GS28002 RS485 Connection kit

Spares and Consumables

GS03610 KBr powder (50g)
GS19915 Selector™ 4mm diameter micro cup
GS19916 Selector™ 11mm diameter standard cup
GS19917 Tilted cup - total reflectance measurements
GS19918 Selector™ abrasive pad sample mount
GS19919 Selector™ diabrase abrasive sample pads 12mm diameter (100 off)
GS19931 Environmental Chamber ESK
GS19934 Spare ZnSe housing

Minidiff™ Plus

A diffuse reflectance accessory for routine analysis.

Minidiff™ Plus Diffuse Reflectance Accessory

For routine diffuse reflectance sampling, the Minidiff™ Plus is the ideal accessory of choice.

High performance solids analysis is made simple through a minimal alignment optical system. Solid sampling versatility is maintained through the use of standard sampling cups and Diabrase abrasive sampling pads.

The sample introduction system reduces the risk of sample spillage, with up to 3 samples being loaded at the same time. The Benchmark™ baseplate mounting provides consistent, stable and reliable positioning of the accessory in the spectrometer.

Key features

- Pre-aligned mirrors
- Easy sample handling
- Diabraze sampling
- Benchmark™ baseplate mounted
- Micrometre focusing adjustment

Applications

- Powders
- Intractable solids
- Liquid samples as a dispersion over KBr matrix

ordering information

GS04510 **Minidiff™ Plus**
Diffuse Reflectance Accessory
includes
Optical unit and baseplate
2 Abrasive sample holders with 3 mounts
2 Sample cup holders with three cups
20 Diabrase abrasive pads (9mm dia.)
KBr Powder (50g)
Pestle and Mortar

Spares and Consumables

GS03610 KBr powder (50g)
GS04505 2 Sample cup holders with 3 cups
GS04506 100 Diabrase abrasive pads (9mm dia.)
GS04508 2 Abrasive sample holders with 3 mounts

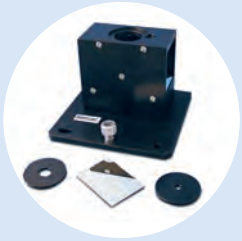
Specular Reflectance Accessories

Page 42

Monolayer/ Grazing Angle Specular Reflectance Accessory

Page 44

Specular Reflectance Accessory 30°



Cost effective and engineered to last

Specular reflectance accessories allow non-destructive spectral analysis of coatings, thin films, or other similar materials, deposited on or pressed against a reflective surface.

Specac offers both ambient temperature and high temperature, high pressure versions of specular reflectance accessory.

Monolayer/ Grazing Angle Specular Reflectance Accessory

A dual purpose sampling device designed to provide the means of in-situ FT-IR monolayer investigation of films at an air or liquid interface and grazing incidence angle measurements of thin film coatings on solid reflective surfaces.

Monolayer/Grazing Angle Specular Reflectance Accessory

The Monolayer/Grazing Angle Specular Reflectance Accessory P/N GS19650 is a dual purpose sampling device designed to provide the means of in-situ FT-IR monolayer investigation of films at an air/ liquid interface and grazing incidence angle measurements of thin film coatings on solid reflective surfaces. The accessory can be easily converted from one form to the other by simple changeover of the appropriate sample holder.

The range of grazing incident angles available with this accessory are from 8° to 85° with no stray light, on most spectrometer systems. Aperture stops are provided to redefine the beam profile, for prime position on samples at or near grazing angles, to enhance the performance.

In the monolayer mode a variety of monolayer systems including surfactants, proteins, detergents, oils, polymers and phospholipids in biological membranes can be studied in their native environment for information such as solvation,

Key features

- Grazing angle capability
- Monolayer analysis
- Continuously variable incidence angles from 8°- 85° (dependant on spectrometer)
- Volume of trough 8.9ml
- Sample size 85 x 22mm liquid & 140 x 35mm solid
- Built-in polarizer mount
- Aperture stop facility for controlling the sampled area
- Liquid film compression/expansion capability
- Inert PTFE sample trough (liquids)

Applications

- Reflection-absorption spectra of solids
- Langmuir-Blodgett films
- Surfactant studies
- Liquids in biological membranes
- Semi-conductors
- Paints
- Resins
- Polymer coatings
- Matt surfaced samples
- Molecular orientation of surfaces

molecular orientation, configuration and phase transition. A special liquid sampling trough, fabricated in PTFE, is used to contain the sample of interest. A rotatable polarizer mount and surface film stretching device are provided to aid in the studies. Any of Specac's P/N GS12000 series polarizers can be placed into the polarizer mount. The polarizer substrate chosen will determine the frequency range that can be observed in the Mid IR.

For solid surface sampling, an alternative flat sampling stage is used within the Monolayer/Grazing Angle accessory in place of the liquid sampling trough.

An important point about the sampling area requirement for the monolayer grazing angle accessory is that it is chiefly dependent on the incident angle of the beam of light being projected to the sample surface.

Whether it is a liquid sample or a solid surface, as the angle gets shallower (i.e. towards the 85° maximum for monolayer experiments) the spread of light across the surface gets larger as the elliptical shaped pool of light gets longer.

You therefore need a longer and thinner sample size area to make use of the available light, to maximise a sample signal. At grazing angles the amount of specularly reflected light can be very low in intensity and hence Specac would normally recommend that a sensitive detection system such as an MCT detector is used for measurement.

For liquid samples, the maximum length and width for a liquid surface is limited to 85mm and 22mm respectively. For the solid sampling platform, the maximum length of sample that can be accommodated is 140mm and the maximum width is 35mm.

The Monolayer/Grazing Angle accessory is baseplate mounted within a spectrometer sample compartment and an appropriate baseplate or fixings are supplied when ordered for a specific spectrometer system. It is not compatible for attachment to a Benchmark™ style baseplate.

However, in the majority of instances, the Monolayer Grazing Angle accessory can be adapted for use in a different spectrometer sample compartment by simple changeover to the appropriate baseplate.

ordering information

GS19650 **Monolayer/Grazing Angle Accessory**
consists of
Optical unit with baseplate
Horizontal sample stage
Aperture stops
Polarizer mount
PTFE sample trough

Please specify make and model of spectrometer

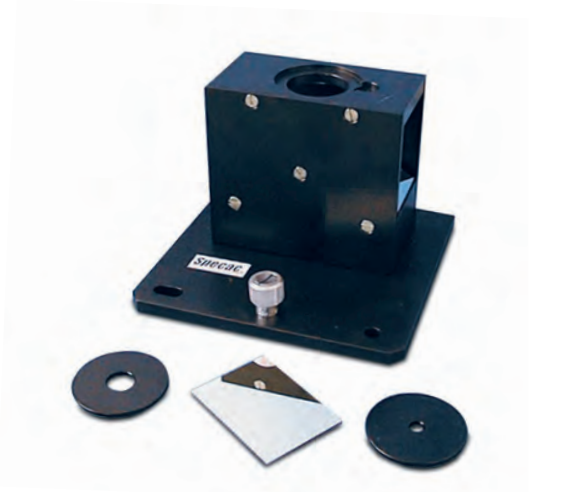
Spares and Consumables

GS19662 PTFE trough for monolayer mode samples

GS19663 Aperture stops and holder for the Monolayer/Grazing Angle accessory

Specular Reflectance Accessory 30°

For surface analysis of solids by specular reflectance.



Key features

- 30° fixed angle
- Convenient horizontal sample position
- (20.8mm diameter full aperture)
- Accommodates powder samples
- Suitable for dispersive and large beam FT-IR
- Minimal alignment

Applications

- Analysis of surface coatings (polymer, optical)
- Local analysis of defects and inclusions
- Fragile samples

Specular Reflectance Accessory 30°

Specular reflectance is a non-destructive method for surface measurements using a mirror-like reflection from the shiny or semi-matt surface of a sample. Specular reflectance occurs when the reflected angle of infrared radiation equals the angle of incidence. The amount of light reflected depends on the angle of incidence, the refractive index, surface roughness and absorption properties of the sample.

The fixed angle specular reflectance accessory P/N GS19820 allows for a beam of radiation at a fixed angle of 30 degrees incidence to fall upon the surface of a solid material, in order to gain spectroscopic information on any surface layers of the flat solid sample. (Liquids or gums etc. cannot be analysed due to the orientation of the sample).

The solid sample is inverted and placed over the aperture at the top of the accessory. The incident beam is projected from a fixed mirror block surface to the sample surface and is specularly reflected from the sample surface back to the fixed mirror block and then directed to the detector. The sample spectral collection is carried out after a reference spectrum has been collected using the reference mirror (supplied) in place of the sample. There are two different aperture stops (5mm and 10mm dia.) that can be used to mask down the area of study on the sample if desired. The sample sits flat over the aperture and its size is necessarily limited by the dimensions of the sample compartment and the size of the aperture stop chosen.

The accessory is installed within a spectrometer using a Benchmark™ type baseplate and so when ordering, you need to state which spectrometer is to be used to receive the appropriate baseplate.

ordering information

GS19820 **Specular Reflectance Accessory 30°**

Fixed Angle Specular Reflectance for FT-IR Spectrometers
includes:
Optical unit
Reference mirror
Sample aperture masks
(5mm and 10mm diameter)

Infrared Transmission Spectroscopy

Specac delivers performance and value

Transmission sampling techniques are applicable for liquid, solid, and gas spectroscopic analysis in the UV, visible, NIR, and infrared.

Specac provides a variety of products and consumables to meet these spectroscopic transmission analysis needs.

IR Transmission Spectroscopy Introduction

Transmission spectroscopy is the oldest and simplest technique for analysing samples in the infrared.

Transmission spectroscopy

Transmission spectroscopy is the oldest and simplest technique for analysing samples in the infrared.

This method of analysis is based upon the absorption of the infrared beam by a sample at specific wavelengths. Different compounds each display a unique infrared spectrum allowing them to be identified.

The extent of absorption 'A' is defined by the Beer-Lambert Law: A=abc where 'a' is the absorptivity coefficient, 'b' is the pathlength, and 'c' is the concentration. This law enables scientists to use infrared data to determine quantitative information.

Small amounts of sample can be analysed by using an appropriate microsample holder in conjunction with a beam condenser.

Solids

A variety of methods exist for analysing solid samples by transmission spectroscopy. Thin polymer films can be analysed directly by using a film holder.

Transmission spectra of solids can also be obtained by grinding the sample together with an infrared transparent matrix, such as KBr, and pressing the resulting powder into a thin disk.

Another method of analyzing solids is to make a mull by combining the sample with a liquid paraffin, such as Nujol, and placing it between two infrared transparent windows.

A diamond compression cell is available for transmission studies of single fibres and other micro samples.

Liquids

In transmission spectroscopy, liquids are analysed as a thin film sandwiched between two windows in a liquid cell. The type of cell, choice of window material, and pathlength is determined by the sample.

Samples can be analysed neat, or diluted with an appropriate solvent. In order to perform quantitative analysis, the sample should be analysed in a cell with a known pathlength. A guide to pathlength selection for different concentrations in the mid infrared is shown below.

Analytical concentration	Typical pathlength
> 10 %	0.05 mm
10 % – 1 %	0.1 mm
1 % – 0.1 %	0.2 mm
< 0.1 %	> 0.5 mm

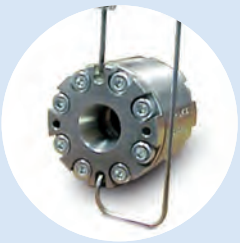
Gases

Gases have densities several orders of magnitude lower than liquids and solids at standard temperature and pressure.

Therefore, transmission spectroscopy of gases requires cells with a longer pathlength than those used for liquid or solid analyses, usually 10 cm or longer.

Low concentrations of gases require a pathlength of several meters. This is achieved in a short space by using a multi-pass cell, where the infrared beam is bounced through the sample several times in order to obtain the desired pathlength.

Liquid/Solid Cells



A wide range for every application

Specac offers a selection of sealed and demountable liquid transmission cells to suit a variety of UV, visible, NIR, and infrared application needs.

These range for entry-level ambient temperature transmission sampling cells, to high-temperature high-pressure transmission sampling cells for advanced liquid transmission spectroscopic analysis.

Spectroscopic transmission cells are available with a choice of high-quality window materials to match analytical needs.

Pearl™ Liquids Analyser

The easiest to use FTIR liquid sampling system available.

Pearl™ Liquids Analyser

The Pearl™ is a high specification liquid transmission accessory designed for laboratory spectroscopic sample analysis in the near and mid Infrared.

The Pearl™ accessory contains Specac's innovative Oyster™ Lift and Tilt cell assembly, which holds the sample in a horizontal plane. The top Oyster™ cell is simply lifted and tilted to one side to allow for fast and easy application of the sample, and for cleaning between samples.

For more volatile samples, there is an injection access port in the top Oyster™, so the cell assembly does not have to be fully opened. At all times, the sample can be viewed through the two windows, allowing the user to ensure that no bubbles have been trapped.

The Oyster™ cell can be cleaned very easily and quickly using tissue and an appropriate solvent. The Pearl™ has been designed to provide a more accurate pathlength than can been achieved using a traditional liquid transmission accessory, with pathlengths repeatable to significantly better than 1µm thanks to the innovative 'Lift and Tilt' mechanism. Oyster™ cells have the unique feature of being offered as either parallel or wedged cells to eliminate troublesome fringing.

Pearl™ can be fitted with ZnSe or CaF2 windows which can be interchanged in seconds. Oyster™ cells are available in five pathlengths, 50µm, 100µm, 200µm, 500µm and 1,000µm.

Key features

- The easiest to use FTIR liquid sampling system available
- Faster, more accurate and more repeatable than traditional liquid cells
- Wedged cell option to eliminate troublesome fringing completely
- Different pathlengths and window materials changed in seconds
- Handles viscous materials with ease

Key applications

- In-service oil analysis
- Quantitative and qualitative analysis
- Adulterated edible oil analysis
- Highly viscous samples such as greases

The Oyster™ cell mechanism is so easy to use that it makes the Pearl™ accessory suitable for handling highly viscous samples such as oils and greases.

The Benchmark™ Baseplate System

Specac believe that your accessory should be able to be quickly and easily switched from instrument to instrument in your laboratory.

To facilitate this we have developed the Benchmark™ Baseplate system as an interface between the accessory and instrument, and to which the

Pearl™ Liquids Analyser

accessory can be fitted with a single thumbscrew fixing. The Benchmark™ Baseplate is unique to the instrument model being used (a baseplate is supplied with the Pearl™ accessory) and can be left in the sample compartment, if required, for use with other Specac Benchmark™ compatible accessories.

ordering information

Pearl™ base unit

- Blue: **GS31000-A**
- Black: **GS31000-B**
- Green: **GS31000-G**
- Orange: **GS31000-O**
- Purple: **GS31000-P**
- Red: **GS31000-R**
- Yellow: **GS31000-Y**

Oyster™ - complete

		Pathlength					
Window	**Wedge**	**25µm**	**50µm**	**100µm**	**200µm**	**500µm**	**1000µm**
ZnSe	Parallel windows	GS31216	GS31211	GS31212	GS31213	GS31214	GS31215
ZnSe	Wedged windows	GS31226	GS31221	GS31222	GS31223	GS31224	GS31225
CaF_2	Parallel windows	GS31316	GS31311	GS31312	GS31313	GS31314	GS31315
CaF_2	Wedged windows	GS31326	GS31321	GS31322	GS31323	GS31324	GS31325

Oyster™ - top

Window	
ZnSe	GS32200
CaF_2	GS32300

Oyster™ - bottom

		Pathlength					
Window	**Wedge**	**25µm**	**50µm**	**100µm**	**200µm**	**500µm**	**1000µm**
ZnSe	Parallel windows	GS33216	GS33211	GS33212	GS33213	GS33214	GS33215
ZnSe	Wedged windows	GS33226	GS33221	GS33222	GS33223	GS33224	GS33225
CaF_2	Parallel windows	GS33316	GS33311	GS33312	GS33313	GS33314	GS33315
CaF_2	Wedged windows	GS33326	GS33321	GS33322	GS33323	GS33324	GS33325

Omni-Cell™ System

A Universal Transmission Cell for the analysis of liquids and mulls in FT-IR or Dispersive Spectroscopy.

Omni-Cell™ System

The Omni-Cell™ System is a low cost novel approach to the analysis of liquid samples in transmission spectroscopy - one cell is suitable for all applications.

The cells are compatible with all FT-IR Spectrometers as well as older dispersive systems and can easily be configured for use as demountable liquid cells, permanently sealed liquid cells or as mull cells.

Transmission is a well established technique for analyzing samples in the infrared. The choice of window material, pathlength and window configuration are determined by the sample and wavelength range of interest. Samples can be analysed neat or diluted with an appropriate solvent. For quantitative analysis, the sample is often analysed in a cell with a known pathlength. A guide to the selection of the correct pathlength for various concentrations is given below:

Analytical concentration	Typical pathlength
> 10 %	**0.05 mm**
10 % – 1 %	**0.1 mm**
1 % – 0.1 %	**0.2 mm**
< 0.1 %	**> 0.5 mm**

Solid samples can be analysed using the mull technique. The solid is combined with a mulling agent such as Nujol or Fluorolube to form a mull which is analysed between circular windows.

(All cells are shipped as a kit of parts and require assembly by the user)

Key features

- Quick to assemble and change windows
- Windows and Spacers compatible with older Specac cells
- FT-IR and Dispersive compatibility
- Quick release clamping mechanism
- Low cost and reliable
- Wide choice of window materials

Applications

Demountable Cells

- General purpose
- All liquids
- Quantitative analysis

Sealed Cells

- Volatile liquids
- Quantitative applications
- Low viscosity liquids

Mull Cells

- High viscosity liquids
- Gels and pastes
- Oils and greases
- Solids suspended as mulls

Demountable Cell

This is a general-purpose cell for all liquids. It has the advantage of being easy to dismantle for cleaning, and for changing windows and spacers.

Applications

- General purpose
- All liquids
- Quantitative analysis

Sealed Cell

The window pair and spacer are amalgamated as an assembly. The advantages of this cell are constant pathlength for quantitative analysis and suitability for use with volatile liquids.

Applications

- Volatile liquids
- Quantitative applications
- Low viscosity liquids

Mull Cell

The Mull Cell does not use the standard liquid filling ports. A suitable sample is placed between 2 circular windows, then squeezed together by tightening the Omni-Cell™ body parts. The advantage is that very viscous liquids, gels and pastes can easily be analysed.

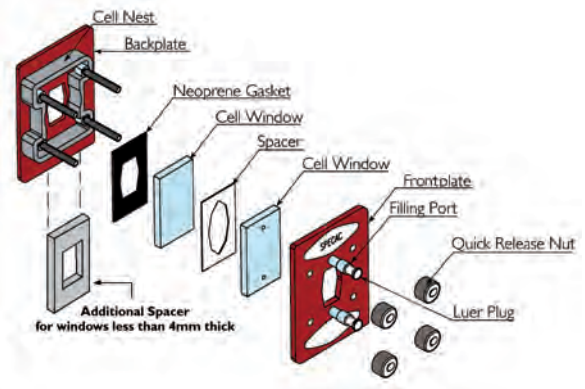
Applications

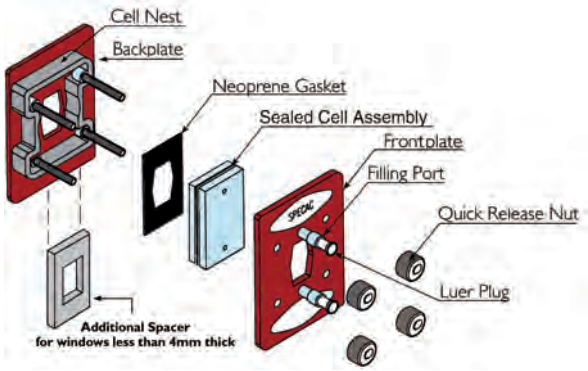
- High viscosity liquids
- Gels and pastes
- Oils and greases
- Solids suspended as mulls

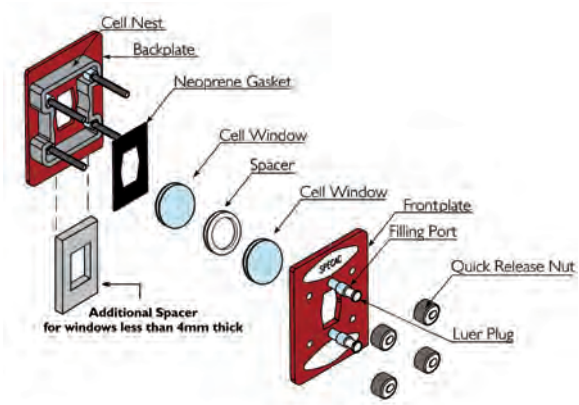
Liquid Omni-Cell™ Volumes

(Rectangular windows - top drilled, bottom undrilled)
Mylar spacer 0.006 mm thick - 1.82 microliters
Mylar spacer 0.012 mm thick - 3.64 microliters
Mylar or lead spacer 0.025 mm thick - 7.5 microliters
PTFE or lead spacer 0.05 mm thick - 15.50 microliters
PTFE or lead spacer 0.10 mm thick - 30.00 microliters
PTFE or lead spacer 0.20 mm thick - 60.00 microliters
PTFE or lead spacer 0.50 mm thick - 150.00 microliters
PTFE or lead spacer 1.00 mm thick - 300.00 microliters

N.B. Please note that the figures produced are for an approximate volume of liquid contained between the window faces only. It does not include any extra amount of liquid that may be contained in the filling port sections of either type of liquid cell.







ordering information

Ordering an Omni-Cell™ is easy - just order the Universal Omni-Cell™ Body, and buy the windows and spacers to suit your application.

GS01800 **The Omni-Cell™ Body** includes front and back plates, cell nest, 4 quick release nuts, bonded front PTFE gasket, rear neoprene gasket and 2 PTFE Luer plugs.

Demountable Liquid Omni-Cell™ Window Pairs (Rectangular) 41mm x 23mm

GS01810	NaCl Liquid Omni Windows
GS01811	KBr Liquid Omni Windows
GS01812	CaF2 Liquid Omni Windows
GS01813	BaF2 Liquid Omni Windows
GS01814*	ZnSe Liquid Omni Windows
GS01815	KRS-5 Liquid Omni Windows
GS01818*	Silica (IR) Liquid Omni Windows
GS01819*	AgBr Liquid Omni Windows
GS01820*	Silicon Liquid Omni Windows
GS01821*	Polythene Liquid Omni Windows

Liquid Omni-Cell™ Spacers (Rectangular)

GS01850	0.05mm PTFE Spacers (5)
GS01851	0.10mm PTFE Spacers (5)
GS01852	0.20mm PTFE Spacers (5)
GS01853	0.50mm PTFE Spacers (5)
GS01854	1.00mm PTFE Spacers (5)
GS01855	0.025mm Lead Spacers (5)
GS01856	0.05mm Lead Spacers (5)
GS01857	0.10mm Lead Spacers (5)
GS01858	0.20mm Lead Spacers (5)
GS01859	0.50mm Lead Spacers (5)
GS01860	1.00mm Lead Spacers (5)
GS01861	0.006mm Mylar Spacers (5)
GS01862	0.012mm Mylar Spacers (5)
GS01863	0.025mm Mylar Spacers (5)
GS01864	Assorted PTFE Spacers (10) 2 of each thickness supplied

Mull Omni-Cell™ Window Pairs (Circular) 25mm Dia

GS01830	NaCl Mull Omni Windows
GS01831	KBr Mull Omni Windows
GS01832	CaF2 Mull Omni Windows
GS01833	BaF2 Mull Omni Windows
GS01834*	ZnSe Mull Omni Windows
GS01835	KRS-5 Mull Omni Windows
GS01838*	Silica (IR) Mull Omni Windows
GS01839*	AgBr Mull Omni Windows
GS01840*	Silicon Mull Omni Windows
GS01841*	Polythene Mull Omni Window

Mull Omni-Cell™ Spacers (Circular)

GS01870	0.05mm PTFE Spacers (5)
GS01871	0.10mm PTFE Spacers (5)
GS01872	0.20mm PTFE Spacers (5)
GS01873	0.50mm PTFE Spacers (5)
GS01874	1.00mm PTFE Spacers (5)
GS01875	0.025mm Lead Spacers (5)
GS01876	0.05mm Lead Spacers (5)
GS01877	0.10mm Lead Spacers (5)
GS01878	0.20mm Lead Spacers (5)
GS01879	0.50mm Lead Spacers (5)
GS01880	1.00mm Lead Spacers (5)
GS01881	0.006mm Mylar Spacers (5)
GS01882	0.012mm Mylar Spacers (5)
GS01883	0.025mm Mylar Spacers (5)

* These windows require additional spacer P/N GS01893

Permanently Sealed Omni-Cell™ Window Units (Rectangular with Lead Spacer)

These Sealed Cell Assemblies are used in the Omni-Cell™ Body P/N GS01800

Material	0.025 mm	0.05mm	0.10mm	0.20mm	0.50mm	1.00mm
NaCl	GS01910	GS01920	GS01930	GS01940	GS01950	GS01960
KBr	GS01911	GS01921	GS01931	GS01941	GS01951	GS01961
CaF2	GS01912	GS01922	GS01932	GS01942	GS01952	GS01962
BaF2	GS01913	GS01923	GS01933	GS01943	GS01953	GS01963
ZnSe*	GS01914	GS01924	GS01934	GS01944	GS01954	GS01964
KRS-5	GS01915	GS01925	GS01935	GS01945	GS01955	GS01965
CsI	GS01916	GS01926	GS01936	GS01946	GS01956	GS01966
CsBr	GS01917	GS01927	GS01937	GS01947	GS01957	GS01967
Silica (IR)*	GS01918	GS01928	GS01938	GS01948	GS01958	GS01968

Please note: All windows are 4mm thick except ZnSe, Silica (IR), AgBr and Si, which are 2mm and Polythene, which are 3mm thick. These windows require the additional spacer for thin windows P/N GS01893

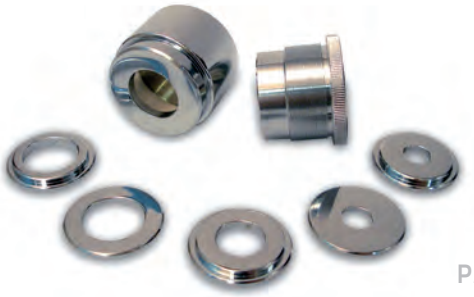
Spares

GS01110	Luer Syringe (2ml)
GS01890	Rear Neoprene Gaskets (2)
GS01891	Quick Release Nuts (4)
GS01892	Luer Plugs for Omni-Cell™ (2)
GS01893	Spacer for thin windows (1)
GS03620	Bottle of Nujol (25ml)
GS03621	Bottle of Fluorolube (25ml)

Advanced Solid Sampling Cells

Choice of sample sizes from 12mm to 30mm diameter and 0.1mm to 8mm thick.

P/N GS20600



P/N GS20610

There are two types of solids holder, P/N GS20600 and P/N GS20610. P/N GS20600 is used in the Electrical Heating Jacket P/N GS20730.

The body has a fixed size aperture of 10mm and hence solid samples can be analysed from 12mm to 28mm dia. and up to 3mm thick.

P/N GS20610 is used in the Variable Temperature Cell Holder P/N GS21525. The solids holder consists of outer and inner cell threaded bodies and three pairs of pressure plates. The varying aperture sizes of the pressure plates enable samples with a diameter of 12 - 17mm, 17 - 22mm and 22 - 30mm and thicknesses of a few microns to 8mm thick to be analysed.

Both of the solids holders do not require any windows for operation.

ordering information

GS20600 **Solids Holder for Heating Jackets** P/N GS20730 and P/N GS20710

GS20610 **Solids Holder for Variable Temperature Cell** P/N GS21525

Specac brilliant spectroscopy

Advanced Liquid Sampling Cells

For high sensitivity ATR measurements with FT-IR or dispersive instruments.

Liquid sampling cells

There are many combinations for liquid cells and they can be provided as static sealed (P/N GS20500 series), static demountable (P/N GS20510 series), flow sealed (P/N's GS20560 and GS20570 series) and flow demountable (P/N's GS20580 and GS20590 series) versions.

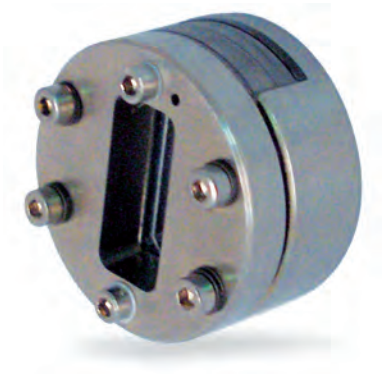
When you order a particular version you will receive the complete cell with windows of choice and a spacer at pathlength of choice all assembled together. Sealed cells have a lead spacer and lead top gasket and all components are permanently amalgamated/sealed together.

Demountable cells have a PTFE spacer and PTFE top gasket and as such allow for windows and spacer pathlengths to be interchangeable within these version cells. A threaded luer fitting, flushing tube, syringe needle, 2 PTFE washers and 3/32" Allen key are also included with the static version cells. The liquid is contained within the static version of liquid cells (sealed or demountable) by threaded stainless steel screw plugs.

The flow cells (GS20570 and GS20580 series) have an alternative front plate with permanent Swagelok connection fittings for 1/16" tubing.

The threaded luer and flushing tube cannot be attached to the flow cell front plate. The P/N's GS20570 and GS20580 series flow cells are, however, only suitable for use in the Electrical Heating Jacket P/N GS20730. For a liquid flow cell to be accommodated in the Variable Temperature Cell holder P/N GS21525, a different type of front flow plate is used with a static sealed GS20500 series cell.

These versions of flow cells for the Variable Temperature Cell Holder are P/N GS20560 series cells. The flow front plate on these liquid cells has two 1/16" stainless steel flow tubes welded to the sample inlet and outlet ports on the plate. The flow tubes are specifically shaped to allow for a liquid flow cell to fit in the Variable Temperature Cell Holder and be connected via Swagelok fittings to an external liquid supply.



Key features

- Choice of pathlength
- Sealed or demountable cells
- Variety of window materials
- Static or flow modes
- Luer fittings and stainless steel plugs

Specac recommends use of a sealed cell within the Variable Temperature Cell Holder to offer the best sealing integrity to contain a liquid sample when in the local operating vacuum environment.

There are demountable flow cell equivalent versions of these sealed liquid flow cells that could be used in the Variable Temperature Cell holder. The flow front plate with stainless steel tubing and Swagelok fittings is attached to the demountable liquid cells GS20510 series. These demountable flow cells are GS20590 series type cells.

Either a sealed (GS20560 series) or demountable (GS20590 series) flow cell can be used in both the Variable Temperature Cell Holder and Electrical Heating Jacket. It is important to note that the P/N's GS20570 and GS20580 series flow cells cannot be used in the Variable Temperature Cell Holder. Please note that in order to use the flow cells in the Variable Temperature Cell Holder the flow option GS20080 must be fitted.

Advanced Liquid Sampling Cells

Liquid Cells GS20500 Series volumes

(Rectangular windows - top drilled, bottom undrilled)
Mylar spacer 0.006 mm thick - 1.60 microliters
Mylar spacer 0.012 mm thick - 3.25 microliters
Mylar or lead spacer 0.025 mm thick - 6.80 microliters
PTFE or lead spacer 0.05 mm thick - 13.50 microliters
PTFE or lead spacer 0.10 mm thick - 27.00 microliters
PTFE or lead spacer 0.20 mm thick - 54.00 microliters
PTFE or lead spacer 0.50 mm thick - 135.00 microliters
PTFE or lead spacer 1.00 mm thick - 270.00 microliters

N.B. Please note that the figures produced are for an approximate volume of liquid contained between the window faces only. It does not include any extra amount of liquid that may be contained in the filling port sections of either type of liquid cell.

ordering information

GS20500* **NaCl Sealed Heatable Liquid Cell**
(Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20501* **KBr Sealed Heatable Liquid Cell**
(Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20502* **CaF2 Sealed Heatable Liquid Cell**
(Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20503* **BaF2 Sealed Heatable Liquid Cell**
(Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20508* **ZnSe Sealed Heatable Liquid Cell**
(Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20510** **NaCl Demountable Heatable Liquid Cell**
(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20511** **KBr Demountable Heatable Liquid Cell**
(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20512** **CaF2 Demountable Heatable Liquid Cell**
(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20513** **BaF2 Demountable Heatable Liquid Cell**
(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20519** **ZnSe Demountable Heatable Liquid Cell**
(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

* Includes a complete cell with front plate, top lead gasket, top window, lead spacer (choice of pathlength) and bottom window all sealed together.

** Includes a complete cell with front plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

Windows for Liquid Cells

GS20520 **Pair of NaCl windows**
GS20521 **Pair of KBr windows**
GS20522 **Pair of CaF2 windows**
GS20523 **Pair of BaF2 windows**
GS20596 **Pair of ZnSe windows**
GS20598 **Pair of Spec B (UV) windows**

Spares and Consumables for Liquid Cells

GS20040 **10 off Front & Rear PTFE Gaskets**
GS20050 **PTFE and Mylar Spacers Assorted**
(2 each of 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)***
GS20070 **10 off PTFE and Mylar Spacers** (select from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)***
GS10030 **Flushing Tube Kit**
GS10040 **Threaded Luer Fitting**
GS10050 **10 off Syringe Needles**
GS10060 **2 off Stainless Steel Plugs**
GS10070 **10 off PTFE Sealing Washers**

Heatable Cell

GS20539 **Heatable Liquid Static Cells ESK**

*** Please note that 0.006, 0.012 and 0.025mm spacers are only available in Mylar while all other sizes are in PTFE only.

Flow Cells for Variable Temperature Cell Holder & Heating Jackets

Please note :- In order to use the flow cells in the Variable Temperature Cell holder (GS21525) the flow option kit GS20080 must be fitted.

ordering information

GS20560* **NaCl Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20561* **KBr Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20562* **CaF2 Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20563* **BaF2 Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20566* **ZnSe Sealed Heatable Liquid Cells** with 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20590* **NaCl Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20591** **KBr Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20592** **CaF2 Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

P/N GS20560/90

Key features

- Choice of pathlength
- Sealed or demountable cells
- Variety of window materials
- Flow mode

GS20593** **BaF2 Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20594** **ZnSe Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

Heatable Flow Cell

GS20569 **Heatable Liquid Flow Cell ESK**

* Includes a complete cell with front flow plate, top lead gasket, top window, lead spacer and bottom window all sealed together.

** Includes a complete cell with front flow plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

Flow Cells for Heating Jackets

Flow Cells for P/N GS20710 and GS20730 only

ordering information

GS20570* **NaCl Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20571* **KBr Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20572* **CaF2 Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20573* **BaF2 Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20576* **ZnSe Sealed Heatable Liquid Cell** with 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

GS20580** **NaCl Demountable Heatable Liquid Cells** 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20581** **KBr Demountable Heatable Liquid Cells** 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.006, 0.012, 0.05, 0.025, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20582** **CaF2 Demountable Heatable Liquid Cells** 1/1 6" Swagelok fittings for flow purposes. (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

GS20583** **BaF2 Demountable Heatable Liquid Cells** 1/1 6" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

Key features

- Choice of pathlength
- Sealed or demountable cells
- Variety of window materials
- Flow mode

GS20586** **ZnSe Demountable Heatable Liquid Cells** with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

Heatable Flow Cell

GS20569 **Heatable Liquid Flow Cell ESK**

* Includes a complete cell with front flow plate, top lead gasket, top window, lead spacer and bottom window all sealed together.

** Includes a complete cell with front flow plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

High Pressure Liquid Cell

High Pressure Liquid Cell

Specac produce High Pressure Liquid Cells that are capable of being operated to 5000psi with Sapphire or Spectrosil B windows and 2000psi with ZnSe windows. The pathlength of these cells can be 0.1mm, 0.2mm, 0.5mm, 1.0mm, 2mm, 5mm or 10mm as standard. The windows are permanently sealed in their window housing assemblies using Viton material O-rings and for most purposes the cells are rated to 180°C temperature operation. The cells as standard are provided with their own 3" x 2" mounting plate, which can be removed if the cell is placed into a heating accessory.

There are two 1/16" stainless steel flow tubes brazed to the High Pressure Liquid Cell body to introduce the fluid to the inner chamber of the cell. The cell can be filled for static operation or for flow. There is no security valve or over-pressurization device fitted as standard to the cell, but because the flow tubing is connected via Swagelok fittings, a safety device could be attached in line at this point to the Swagelok connections if required.

To be heated, the High Pressure Liquid Cell requires a heating device such as the Electrical Heating Jacket and temperature controller (GS20730), or the Variable Temperature Cell holder and temperature controller (GS21525).

Either heating accessory is designed to fit into the sampling compartment of a spectrometer via the standard 3" x 2" mounting plate, with the High Pressure Liquid Cell fitting directly into the Electrical Heating Jacket or the cell holder part of the Variable Temperature Cell holder. As an additional mounting option, the Variable Temperature Cell Holder can also be installed into a spectrometer via an appropriate Benchmark™ Baseplate.

For a volume of fluid needed to fill the High Pressure Liquid Cell, the smallest pathlength cell at 0.1mm requires approximately 15 microliters of fluid, whereas the 10mm pathlength cell requires 15 milliliters. This is the approximate amount of fluid that will be contained in the inner cell chamber at any time, irrespective of it being operated for static or flow conditions.

As standard the High Pressure Cells are fabricated in EN58 stainless steel but other materials are available on request.

Key features

- Choice of pathlength
- Sealed to ensure pressure capability
- Choice of windows from ZnSe, Spec B or sapphire

ordering information

GS05910 **High Pressure Short Pathlength Cell** 2000 psi (Specify pathlength from 0.5, 1 and 2mm and window material from ZnSe, Sapphire and Spec B)

GS05915 **High Pressure Short Pathlength Cell** 5000 psi (Specify pathlength from 0.5, 1 and 2mm and window material from Sapphire or Spec B)

GS05920 **High Pressure Long Pathlength Cell** 2000 psi (Specify pathlength from 5 and 10mm and window material from ZnSe, Sapphire and Spec B)

GS05925 **High Pressure Long Pathlength Cell** 5000 psi (Specify pathlength from 5 and 10mm and window material from Sapphire and Spec B)

Window Polishing Kit

Keep windows in top condition with the Specac Window Polishing Kit.

Window Polishing Kit

This kit contains all the essential materials required to clean and repolish windows to a flatness within a few fringes. It is especially effective in use with window materials such as NaCl and KBr. Repolishing can be achieved efficiently and economically with a minimum degree of skill.

Full instructions are included and all consumable parts are replaceable.

ordering information

GS04000 **Polishing Kit Complete**
GS04010 **Polishing Selvyt** (self adhesive pads) (5)
GS04040 **Polyethylene bottle** (2)
GS04050 **Cleaning sponge** (1)
GS04060 **Bottle of polishing rouge** (approx 75g net)
GS04080 **Plain Selvyt strips** (2) (non adhesive)
GS04090 **Lapping paper** (5)
GS04095 **Brushes** (2)

Kit includes

- Polishing Selvyt
- Polyethylene bottle
- Cleaning sponge
- Bottle of polishing rouge
- Plain Selvyt strips
- Lapping paper
- Brushes

Chocolate content analysis

SPECAC APPLICATION NOTE

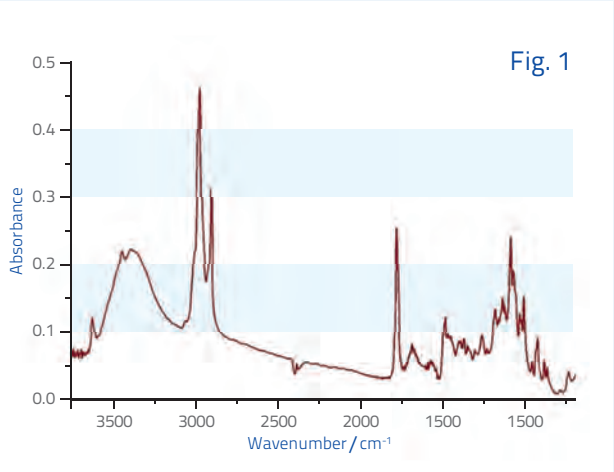
Cocoa beans are a versatile foodstuff that produce tasty treats and sweet scents. Confectionaries like chocolate bars can be made with different fat, sugar and water ratios.

This note demonstrates that the Pearl™ IR transmission accessory can be used to determine the quality and content of chocolate in post-production, for quality assessment purposes.

Methods and results

A small sample of a well known milk chocolate (~10 mg) was warmed gently and pasted onto the bottom ZnSe window of the Pearl™ Oyster Cell. The pathlength of the cell was 25 µm but longer pathlengths are available for weaker absorbing samples.

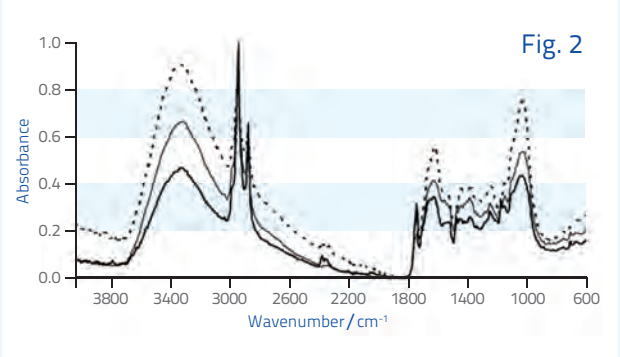
Fig. 1 shows the FTIR spectrum of the chocolate, as recorded using the Pearl™ in a spectrometer and with a resolution of 2 cm^{-1} over an average of 10 scans.



The fingerprint region in Fig. 1 displays the hallmarks of cocoa products, most notably the C=O stretch at 1758 cm^{-1}, typical of an ester and the CH2 absorption from fat at 1462 cm^{-1}. Other significant peaks include the absorption bands at 2924 & 2854 cm^{-1}.

The intensities of these bands can be used to assess the quality of the chocolate.

A published FTIR spectrum of cocoa butter is shown in Fig. 2, recorded using the Specac Golden Gate® ATR accessory.



This spectrum was taken from a study featured in Analytica Chimera Acta, which is available on the World Cocoa Foundation's website.

Fig. 2 is complementary to the spectrum recorded using the Pearl™. Moreover, the ability to distinguish the fat content for different cocoa butter samples is demonstrated.

CONCLUSION

Recording FTIR spectra using the Pearl™ is a quick method to determine the chemical composition of cocoa products. Moreover, the Pearl™ offers a user-friendly way of recording reproducible and reliable spectra.

The recorded spectrum matches quite well with the literature and therefore the Pearl™ would be suitable for the cocoa industry.

Sample Cell Holders

An advanced range of sample cell holders

A range of sample cell holders are available for use with Specac's liquid and solid advanced transmission cells, cuvettes, and diamond compression cell, as appropriate. These allow either ambient temperature analysis, or heated/cooled spectroscopic analysis over a broad temperature range.

Sample Cell Holders introduction

Advanced Solid and Liquid Sample Cell Holders for Variable Temperature, Pressure and flow conditions.

Specac offers a range of transmission accessories to allow a sample to be studied at temperatures other than ambient.

The Variable Temperature Cell holder (P/N GS21525) can be used for the temperature range of -190°C to 250°C and the Electrical Heating Jacket (P/N GS20730) is used for temperatures from ambient to 250°C. Specific sample cell holders for liquids and solids are used within these accessories.

These are known as GS20500/GS20510 Series liquid cells and GS20600 and GS20610 solid cells. Liquid cells are supplied with windows from a wide range of materials, to suit for specific sample applications. (A comprehensive list of IR transmitting materials and their properties can be found at the back of the Specac catalogue.)

All of the sample cells can also be operated at ambient temperature and pressure when used with the 3" x 2" mount sample holder (P/N GS20740). For experiments at high pressures, High Pressure Heatable Liquid Flow Cells (P/N GS05910) series can be used in the Electrical Heating Jacket and Variable Temperature Cell holder. These cells are supplied with their own 3" x 2" mounting plate for use in Spectrometers at ambient temperature.

20500/20510 Series Liquid Cells Solids Holders & High Pressure Liquid Cells and Mount Holders compatibility table

Key: ■ = compatible *Cell holder/Mount**

Cell Series Type	*VT Cell / GS21525**	*EHJ / GS20730**	*WHJ / GS20710**	*Ambient / GS20740**
Liquid Cells				
GS20500 Sealed/Static	■	■	■	■
GS20510 Demountable/Static	■	■	■	■
GS20560 VT Cell Sealed/Flow	■	■	■	■
GS20570 EHJ Sealed/Flow		■	■	■
GS20580 EHJ Demountable/Flow		■	■	■
GS20590 VT Cell Demountable/Flow	■	■	■	■
Solids Holders				
GS20600		■	■	■
GS20610	■		■	■
High Pressure Liquid Cells				
GS05910	■	■	■	
GS05915	■	■	■	
GS05920	■	■	■	
GS05925	■	■	■	

Variable Temperature Cell Holder

For the analysis of liquids or solids between -190°C and 250°C.

Variable Temperature Cell Holder

The Variable Temperature Cell Holder P/N GS21525 is the ideal accessory to use for the transmission study of liquid or solid samples at various temperatures ranging from -190°C to 250°C.

The Variable Temperature Cell Holder consists of a vacuum jacket with two window ports and a set of windows (NaCl as standard) which contains a refrigerant dewar/cell holder assembly. Liquid or solid sample holders are inserted into the heating block part of the dewar/cell holder and the assembled cell is operated within a vacuum environment maintained by the outer jacket.

Using a combination of refrigerant and control from the cell block heaters any temperature from -190°C to 250°C can be achieved. Choice of window materials for both the jacket and sample cell holders allows for use of this accessory in the UV, visible and IR regions.

The Variable Temperature Cell Holder is supplied with a high stability controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

For certain applications such as Raman, Fluorescence and UV spectral measurements Specac offer a four window port version on the vacuum jacket as the Variable Temperature Cuvette Holder (GS21530), special quartz glass cuvettes are used to contain a liquid sample. The four window ports allow for collection of the scattered radiation from a cuvette cell at a 90 deg incident angle as well as at a 180 deg (standard tranmission) as measured from the Variable Temperature Cell Holder (GS21525). (Note cuvettes not supplied by Specac).

Key features

- Programmable controlled temperatures from -190°C to 250°C
- Dewar cooling system
- Heated Jacket windows to prevent condensation
- Flow mode option kit for liquids
- Benchmark™ Baseplate or 3"x2" mounting options

Applications

- Analysis under extreme temperature conditions
- Absorption band study at low temperatures
- Polymerization studies
- Phase transition studies
- Reaction kinetics
- Polymorphism
- Catalysis
- Oxidation studies

Variable Temperature Cell Holder

ordering information

GS21525 **Variable Temperature Cell Holder**
Includes: Refrigerant dewar/cell holder
2 window port vacuum jacket with pair of NaCl windows (P/N GS 20800)
Fixed thermocouple (copper-constantan)
Low voltage supply cables
High Stability Temperature Controller with factory fitted option for control via RS232, RS485 or USB connectivity if ordered
This accessory also requires a liquid or solids sample holder (see pages 53 - 58)

Please specify spectrometer make and model for Baseplate version. For controller specify 220V or 110V and country of usage

GS21530 **4 Port Variable Temperature Cuvette holder**
Includes: Refrigerant dewar/cell holder
4 window port vacuum jacket with 2 pairs of Spectrosil-B quartz glass windows (P/N GS 20898)
Fixed thermocouple (copper-constantan)
Low voltage supply cables
High Stability Temperature Controller with factory fitted option for control via RS232, RS485 or USB connectivity if ordered

Please specify spectrometer make and model for Baseplate version. For controller specify 220V or 110V and country of usage

Replacement Windows for Variable Temperature Cell

GS20800 **Pair of NaCl windows**
GS20801 **Pair of KBr windows**
GS20802 **Pair of CaF2 windows**
GS20803 **Pair of BaF2 windows**
GS20812 **Pair of Polyethylene windows**
GS20896 **Pair of ZnSe windows**
GS20898 **Pair of Spec B (UV) windows**

Spares for Variable Temperature Cell holder

GS20200 **Monitoring Thermocouple** (copper-constantan)
GS20201 **System Control Thermocouple** (copper-constantan)
GS20810 **Replacement set of O-rings**
GS21526 **VT Cell Holder ESK**

Options

GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**

Electrical Heating Jacket

For liquid and solid sampling in transmission from ambient to 250°C

Key features

- Programmable controlled temps. up to 250°C
- Static or flow sampling capabilities
- Fully CE Safety compliant
- Protective water cooling system
- Standard 3" x 2" slide mount

Electrical Heating Jacket

The Electrical Heating Jacket P/N GS20730, is used for the study of samples by transmission spectroscopy over a temperature range from ambient to 250°C. It consists of a central heatable chamber with a front cover plate. Liquid and solid sample cells are placed within the central chamber and held in place by the cover plate. The whole assembly (Jacket plus sample cell) is installed into a spectrometer sample compartment via the 3" x 2" slide mounting plate.

Heating to the Jacket is provided by its own dedicated low voltage (30 Volts) temperature controlling system, that is provided with the Heating Jacket as standard. A water cooling back plate incorporated into the 3" x 2" slide mounting plate of the Jacket acts to keep any heat at the central chamber from spreading to the mount area of the sample compartment during operation.

For the study of liquid samples, the liquid cells of the (GS20500/20510) Series type (static and flow versions) are placed into the Electrical Heating Jackets central chamber. If solid samples are to be analysed, then the specific solids holder (GS20600) is used within the Electrical Heating Jacket.

The Electrical Heating Jacket is supplied with a high stability power controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

ordering information

GS20730 **Electrical Heating Jacket**
Includes: Low voltage heated jacket with water cooling system NiCr/NiAl thermocouple
High Stability Temperature Controller factory fitted option for control via RS232, RS485 or USB connectivity if ordered
This accessory also requires a liquid or solids sample cell (See pages 51 - 57)

Please specify 220V or 110V and country of usage

Options

GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**

Water Heating Jacket

For liquid and solid sampling in transmission to 90°C.

Water Heating Jacket

The Water Heating Jacket is similar to the Electrical Heating Jacket, but it uses circulating water to heat the sample cell. A jacket around the circular aperture is filled with a solution, for example water, heated by a thermocirculating system.

Temperature control of the sample holder is reliant upon this thermocirculating system.

The sample cell holders used with Electrical Heating Jacket can also be used in this accessory.

ordering information

GS20710 **Water Heating Jacket**
Includes, Water Heating Jacket on a 3" x 2" mount
Requires, but does not include:
1. A liquid or solid sample cell
2. Thermocirculating system

Ambient Temperature Cell Holder

The Ambient Temperature Cell Holder has been designed to hold a variety of liquid and solid sample cell holders at ambient temperatures.

ordering information

GS20740 **Ambient Temperature Cell Holder**

Requires, but does not include:
Liquid or solid sample cell

Gas Cells

Page 68
Storm™ 10cm Gas Cell

Page 69
Storm™ 10cm Heated Gas Cell

Page 70
Cyclone™ Gas Cells

Page 77
Tornado™ Gas Cells

Gas transmission cells for every application

A broad variety of gas transmission cells are available for the analysis of gas and vapour phase components in infrared optical spectroscopy. These range from short pathlength gas cells for percent level concentration measurement, to long pathlength gas cells for part-per-billion concentrations. Options include fixed and variable pathlength gas cells, as well as ambient temperature and heated gas cells.

Storm™ 10cm Gas Cell

Designed for routine gas analysis.


P/N GS05000


P/N GS05800

Storm™ 10cm Gas Cell

These gas cells are ideal for analyzing gases and vapors at room temperature and low pressures. Gases and gaseous mixtures can be examined in static or flow modes.

The cells consist of threaded cylindrical vessels with end caps, window seals and removable windows. The cell bodies are available in Pyrex™ and stainless steel.

Pyrex™, PTFE taps, valves and glass cone connectors (10-19 taper) are used for the Pyrex™ cells while stainless steel and Viton™ sealed valves with barbed hose connections are used for the stainless steel cells to introduce samples into these cells.

Key features

- Demountable for ease of cleaning and window replacement
- Choice of cell material: stainless steel or Pyrex™
- Choice of window materials
- Window diameter: 47mm
- Clear aperture: 39mm
- Two ports for static or flow experiments
- Slide mounted cell holder
- Cell volume; 0.125 litres

Applications

- Qualitative gas analysis
- Residual solvent vapour analysis
- Liquid head-space analysis

ordering information

Storm™ 10cm Gas Cells

GS05000 **Storm™ 10cm Pyrex™ Gas Cell** (specify windows)

GS05800 **Storm™ 10cm Stainless Steel Gas Cell** (specify windows)

Cell mounts

GS05030 **Cell Mount for Pyrex™ and Stainless Steel Storm™ Gas Cells**

Replacement windows

GS05020 **Pair of NaCl windows**
GS05021 **Pair of KBr windows**
GS05022 **Pair of CaF2 windows**
GS05023 **Pair of BaF2 windows**
GS05027 **Pair of Fused Silica windows**
GS05096 **Pair of ZnSe windows**

Spares and consumables

GS05040 **Seal kit** for Pyrex™ Gas Cell
GS05803 **Vacuum Valve** for Stainless Steel Gas Cell
GS05804 **Seal kit** for Stainless Steel Gas Cell

Storm™ 10cm Heated Gas Cell

Analyze gaseous samples and vapours from room temperature to 250°C.

Storm™ 10cm Heated Gas Cell

The Storm™ 10cm Heated Gas Cell analyzes gaseous samples and vapours from ambient temperature to 250°C.

The cell is an evacuable stainless steel chamber with an injection septum sample introduction port and is heated by a low voltage (30v) heater surrounding the body.

The exact gas temperature can be measured with an additional monitoring thermocouple (supplied) which passes through a vacuum tight seal into the gas cavity. The cell is supplied with a High Stability Temperature Controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

The cell can be converted to a flow mode via 1/16" stainless steel flow tube in exchange at the injection septum and additional monitoring thermocouple connection ports.

Key features

- Stainless steel construction
- Stainless steel vacuum stopcock
- Chemically resistant window seals
- Choice of window materials
- 10cm pathlength
- 30 volt heater system for operator safety
- Programmable controlled temperature via optional RS232, RS485 or USB connection
- Slide mounting supplied
- Flow mode (optional)
- Window size 47mm diameter
- Clear aperture 39mm diameter
- Cell volume 0.125 litres

Applications

- Gases and vapours at elevated temperatures
- Vapours generated by solids and liquids at elevated temperatures
- Decomposition studies

ordering information

Storm™ 10cm Heated Gas Cell

GS05670 **Series Storm™ 10cm Heated Gas Cell** (specify windows) includes high stability temperature controller

Please specify 220V or 110V & country of usage

Options

GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**

Replacement Windows

GS05020 **Pair of NaCl windows**
GS05121 **Pair of KBr windows**
GS05022 **Pair of CaF2 windows**
GS05023 **Pair of BaF2 windows**
GS05027 **Pair of Fused Silica windows**
GS05096 **Pair of ZnSe windows**

Please note part No GS05121 are thicker KBr windows required for this cell.

Spares and consumables

GS05662 Stainless steel flow tubes (10)
GS05665 Injection Septa (10)
GS05667 Complete seal kit

Cyclone™ Gas Cells

Heatable long pathlength Gas Cells.

Cyclone™ Gas Cells

Based on the White cell principle of multiple lightpasses between an arrangement of reflecting mirrors, Cyclone™ gas cells are available in three sizes:

- **Cyclone™ C2** - Fixed or adjustable pathlengths ranging from 0.5m to 2.5m
- **Cyclone™ C5** - Fixed or adjustable pathlengths ranging from 1m to 8m
- **Cyclone™ C10** - Fixed or adjustable pathlengths ranging from 2.1m to 10.6m

Cyclone™ series gas cells are suitable for operation in all modern FT-IR spectrometers using the Specac Benchmark™ baseplate provided as standard.

Cells are available as standard with a borosilicate glass body for operation at ambient temperatures and pressures ranging from vacuum to 15 psi Protected gold mirrors, internal and external components made from nickel-plated aluminium and stainless steel, and Viton™ 'O' rings are combined to ensure the highest chemical compatibility and protection from leaks.

Vacuum/gas inlet and outlet taps, KBr windows and a purgeable transfer optics box further enhance this already highly featured range.

Unsurpassed Upgradeability

Cyclone's impressive list of optional features means that any analytical challenge can be met. Adjustable pathlength mirror carriages, and a range of fixed pathlength mirror carriages can be used within a single gas cell body to greatly enhance analytical flexibility and reduce costs.

Nickel-plated aluminium bodies can be specified for high pressure operation up to 125 psi, and heating jackets/high stability temperature controllers allow operation at temperatures up to 200°C.

CaF2 or ZnSe windows can be specified to replace the KBr windows offered as standard. There is also an option to replace the standard Viton seals with Kalrez O-rings for more challenging chemical environments.

Purge bellows allow the transfer optics to be used under inert gas atmospheres (e.g. nitrogen) in applications where the elimination of atmospheric H_2O and CO_2 absorbances is required.

Design Excellence

To ensure perfect operation and freedom from unwanted impurities, a number of unique features have been incorporated into the design and manufacture of the Cyclone™ series.

Key features

- Fixed pathlength
- Borosilicate glass body
- Ambient temperature operation
- Vacuum to 15 psi operation
- Gold mirrors (protected)
- Viton™ 'O' ring seals
- KBr windows
- Adhesive-free construction
- Nickel-plated aluminium components
- Vacuum/gas inlet & outlet taps
- Purgeable transfer optics box
- Benchmark™ series baseplate mounting
- CE compliant

Optional features

- Adjustable pathlength mirror carriage
- Additional fixed pathlength mirror carriages (all models)
- ZnSe or CaF2 windows
- Nickel-plated aluminium body for high pressures operation (up to 125 psi)
- Heating jacket / controller for high temperature operation (up to 200°C)
- Pressure gauge kit
- Desiccant storage caps
- Purge bellows
- Laser alignment accessory
- Kalrez O-rings

Cyclone™ Gas Cells

Heatable long pathlength Gas Cells.

Cyclone™ C2

- Pathlength: 0.5m - 2.5m (fixed or adjustable)
- Pathlength steps: 0.5m
- Volume: 0.19 litres
- Dimensions (mm): H384 W153 D120

Cyclone™ C5

- Pathlength: 1m - 8m (fixed or adjustable)
- Pathlength steps: 1m
- Volume: 1.33 litres
- Dimensions (mm): H536 W153 D130

Cyclone™ Gas Cells

Cyclone Gas Cells cells are completely free from adhesives and all of the Viton™ 'O' ring seals are carefully pre-baked to eliminate any contamination from solvents or out-gassing.

Internal screws have small bleed holes drilled into them to prevent any trapped pockets of gas causing sample cross contamination.

CE Compliance

All Cyclone™ series heated gas cell systems are CE compliant ensuring that they can be operated safely at all times under the recommended conditions.

General specifications

- Cell body material: Borosilicate glass (optional metal body)
- Pressure range: Vacuum to 15 psi (optional 125 psi)
- Temperature range: Ambient (optional heated systems available)
- Mirrors: Gold (protected)
- Windows: KBr (optional ZnSe or CaF2)
- Inlet/outlet fittings: Stainless steel taps 'O' rings: Viton™
- Internal components: Nickel-plated aluminium & stainless steel
- Transfer optics: Aluminium mirrors in purgeable optics box
- Cell mount: Benchmark™ Baseplate series

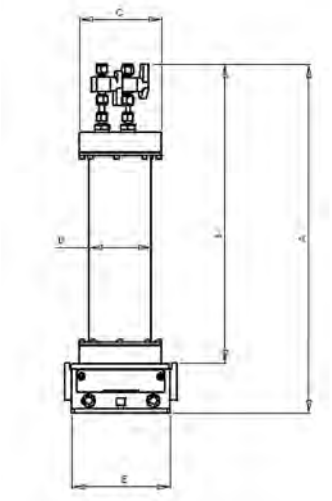
Cyclone™ Gas Cells

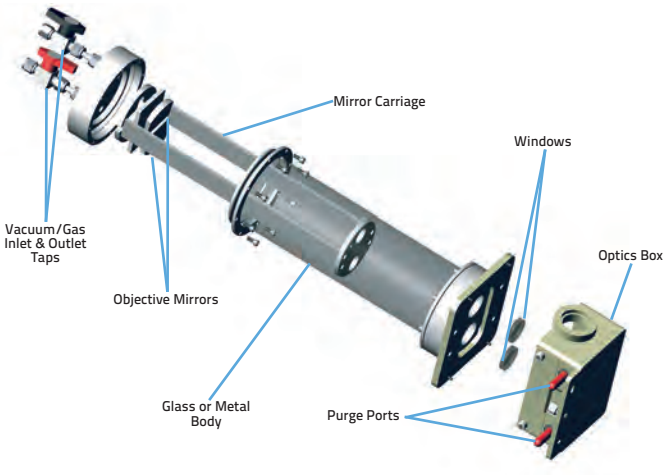
Heatable long pathlength Gas Cells.

Cyclone™ C10

- Pathlength: 2.1m - 10.6m (fixed or adjustable)
- Pathlength steps: 1.06m
- Volume: 2.61 litres
- Dimensions (mm): H540 W153 D1146

Cyclone™ Gas Cells key dimensions below



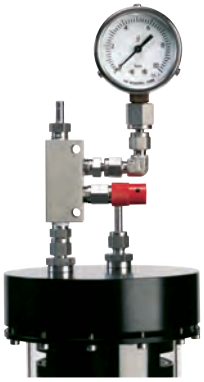


Cell	A	B	C	D	E
C2	384	314	73	47	153
C5	536	466	114	87	153
C10	540	470	143	113	153

All dimensions in mm

Cell	Base Pathlength	Pathlength Range	Volume
C2	12.5cm	0.5m to 2.5m (in 0.5m steps)	0.19 litres
C5	25cm	1m to 8m (in 1m steps)	1.33 litres
C10	26.4cm	2.1m to 10.6m (in 1.06m steps)	2.60 litres

Cyclone™ Gas Cells



Optional features

Cyclone™ series heatable long pathlength gas cells have been designed with the serious analyst in mind. These high performance, superior quality cells are backed by a comprehensive range of optional upgrades ensuring that they meet every analytical challenge.

Purge Bellows

A pair of purge bellows is available for the Cyclone™ series gas cells. These fit between the optics box of the cell and the spectrometer to allow the purging of transfer optics with inert gases such as nitrogen. This feature allows absorbances due to atmospheric H_2O and CO_2 to be eliminated from spectral measurements. These bellows are designed to fit all Specac gas cells.

GS10707 Purge Bellows (pair)

Desiccant Storage Caps

These caps are designed to fit over the optical inlet and outlet ports of the Cyclone™ series gas cells to seal the transfer optics when the cells are not in use.

One of the caps contains a desiccant material which maintains a dry atmosphere within the transfer optics box and extends the life of KBr windows.

GS24150 Desiccant Storage Caps

Pressure Gauge Kit

A pressure gauge kit is available to fit the Cyclone™ series gas cells. Gauges can be specified for low pressure operation (vacuum to 15 psi) and high pressure operation (vacuum to 125 psi - metal bodied cell only). An integral pressure relief valve ensures that cells are automatically depressurised in the event of accidental over pressurisation.

Specac recommend the use of a pressure gauge when operating gas cells at elevated pressures.

GS24160 Pressure Gauge Kit (pair)
(Specify high or low pressure)

Cyclone™ Gas Cells

Optional features

Heating Jacket / High Stability Temperature Controller

All of the Cyclone™ series gas cells (glass and metal bodied versions) can be upgraded to heatable gas cells by the addition of the appropriate Heating Jacket and High Stability Temperature Controller. The heating jacket simply slides over the gas cell and it can be operated from ambient temperatures up to 200°C.

Low voltage (32V) heaters are used to ensure safe operation at all times and the temperature controller has a factory fitted option of RS232, RS485 or USB connectivity if ordered.

Temperature stability is +/-1°C and a key feature of the design is the uniformity of the heating across the whole cell, which prevents localised ˝cold spots˝ within the cell.

All of the Cyclone™ series Heating Jacket / High Stability Temperature Controller systems are CE compliant ensuring that they can be operated safely at all times under the recommended conditions.

ordering information

GS24302 **Heating Jacket/Controller for Cyclone™ C2**
GS24305 **Heating Jacket/Controller for Cyclone™ C5**
GS24310 **Heating Jacket/Controller for Cyclone™ C10**
(Specify voltage and country of usage)

Benchmark™ Series Laser Alignment Accessory

This accessory allows the visual verification of the optical pathlength through Cyclone™ series gas cells.

This is especially useful when different pathlengths are regularly used with variable pathlength cells.

The accessory is based on a low power (0.8mW) visible continuous wave laser diode precisely located in position in a Benchmark™ accessory alignment housing. The gas cell simply slots into the alignment accessory. The 635nm Class II laser can be powered from a battery unit or by the dedicated mains transformer supplied.

Benchmark™ Laser Alignment Accessory is CE compliant ensuring that it can be operated safely at all times under the recommended conditions.

ordering information

GS24500 **Benchmark™ Series Laser Alignment Accessory**
(Specify voltage and country of usage)

Cyclone™ Gas Cells compatibility chart

This guide shows which Cyclone™ gas cell and respective heating jacket can be used within a range of spectrometer sample compartments.

Key: **FWJ** - Fits (and also) With Jacket
FNJ - Fits but No Jacket **DNF** - Does Not Fit

FT-IR Instrument	C2 Cell GS24102	C5 Cell GS24105	C10 Cell GS24110
Bomem M100	FWJ	FWJ	FWJ
Bomem MB100	FWJ	FWJ	FWJ
Bruker IFS66	FWJ	FWJ	FWJ
Bruker Tensor, Vertex, Vector Instruments	FWJ	FWJ	FWJ
Agilent Instruments	FWJ	FWJ	FWJ Close at rear
Mattson Genesis	FWJ	FWJ	FWJ Close at sides
Mattson Galaxy	FWJ	FWJ	FWJ Close at sides
Midac	FWJ	FWJ	FWJ
Nicolet 500, Avatar, Nexus, iS10 Instruments	FWJ	FWJ	FWJ Close at sides
Nicolet iS5	FWJ	FWJ	FNJ
Perkin Elmer 2000 (GX)	FWJ	FWJ	FWJ Close at sides
Perkin Elmer Spectrum One, 100, 400, Frontier Instruments	FWJ	FWJ	FWJ Close at sides
Perkin Elmer Spectrum Two	FWJ	FWJ	DNF
Jasco 400/600V, 5000/7000 instruments	FWJ	FWJ	FNJ
Shimadzu 8400, Prestige 21, IRAffinity Instruments	FWJ	FWJ	FNJ

Note: If your spectrometer is not listed, please contact Specac for further details

Cyclone™ Gas Cells

ordering information

GS24102 **Cyclone™ C2** Long Pathlength Gas Cell 0.5m to 2.5m

GS24105 **Cyclone™ C5** Long Pathlength Gas Cell 1m to 8m

GS24110 **Cyclone™ C10** Long Pathlength Gas Cell 2.1m to 10.6m

Fixed pathlengths available

Cyclone™ C2 - 0.5, 1.0, 1.5, 2.0 & 2.5m
Cyclone™ C5 - 1, 2, 3, 4, 5, 6, 7 & 8m
Cyclone™ C10 - 2.1, 3.2, 4.2, 5.3, 6.3, 7.4, 8.5, 9.5 & 10.6m

Cyclone™ gas cell configuration step by step

1) Choose the size of gas cell with its part number eg for a Cyclone C5 cell the P/N would be GS24105
2) Choose the type of body from Glass (G) or Metal (M)
3) Choose the window material from KBr (K), CaF2(C) or ZnSe (Z) (Note: KBr windows cannot be used with a metal bodied cell)
4) Choose between a Fixed (F) or Adjustable (A) pathlength cell - (if fixed specify the pathlength from those available for the cell size)
5) Choose Viton (V) or Kalrez (X) O-ring seals
6) If required choose a Low (L) or High (H) pressure gauge kit to be fitted

Example: P/N GS24105GCAV would be for a Cyclone C5 cell with a glass body, CaF2 windows, adjustable pathlength, Viton O-rings and no pressure gauge

For all Gas Cells please specify Spectrometer make and model to include provision of the appropriate Benchmark™ baseplate for installation.

Options

GS10707 **Purge Bellows** (pair)
GS24150 **Desiccant Storage Caps**
GS24152 **Mirror Carriage Assembly** for Cyclone™ series gas cells
(specify model, variable or fixed pathlength, and pathlength where a fixed pathlength mirror carriage is required)

GS24160 **Pressure Gauge Kit**
To fit Cyclone™ and Tornado™ gas cells
(specify High or Low Pressure)

GS24302 **Heating Jacket/Controller**
for Cyclone™ C2
(Specify voltage and country of usage)

GS24305 **Heating Jacket/Controller**
for Cyclone™ C5
(Specify voltage and country of usage)

GS24310 **Heating Jacket/Controller**
for Cyclone™ C10
(Specify voltage and country of usage)

GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**
GS24500 **Laser Alignment Accessory**
GS24153 **Replacement KBr windows**
for Cyclone™ and Tornado™ series gas cells
(specify model)
GS24154 **Replacement ZnSe windows**
for Cyclone™ and Tornado™ series gas cells
(specify model)
GS24155 **Replacement CaF2 windows**
for Cyclone™ and Tornado™ series gas cells
(specify model)
GS24103 **Cyclone Gas Cell C2 ESK**
GS24106 **Cyclone Gas Cell C5, C10, ESK**

Gas Cells

Heating Jackets & Laser Alignment Accessory

Tornado™ Gas Cells

A low-cost range of gas cells for routine analysis at ambient conditions.

Tornado Gas Cells

The Tornado™ series is the ideal choice for analysts requiring a fixed, long pathlength gas cell for routine applications.

Based on the White cell principle of multiple light passes between an arrangement of reflecting mirrors, Tornado™ series is available in three sizes:

- **Tornado™ T5** Pathlengths ranging from 1m to 8m in 1m steps
- **Tornado™ T10** Pathlengths ranging from 2.1m to 10.6m in 1.06m steps
- **Tornado™ T20** Pathlengths ranging from 2m to 20m in 2m steps

Tornado™ series gas cells are suitable for operation in all modern FT-IR spectrometers using the Specac Benchmark™ baseplate provided as standard.

Borosilicate glass body material and anodised aluminium/stainless steel internal and external components provide superior corrosion resistance against a wide range of gases and vapors. Viton™ 'O' rings ensure leak-free performance under vacuum and ambient pressures as standard.

There is an option to configure the Tornado cell with a nickel coated aluminium body in place of the borosilicate glass for pressure up to 125 psi. State-of-the-art optical design combined with gold mirrors ensures the highest possible light throughput giving superior analytical sensitivity.

The supreme, in-built flexibility of the Tornado™ series allows additional mirror carriages to be used in the same body shell, maximising analytical capability and minimising operational costs.

Standard features

- Wide pathlength range (1m - 20m)
- Vacuum to 15 psi operation
- Ambient temperature operation
- Borosilicate glass body
- Anodised components
- Gold mirrors (protected)
- Viton™ 'O' ring seals
- KBr, ZnSe or CaF2 windows
- Purgeable transfer optics box
- Benchmark™ series baseplate mounting

Optional features

- Additional mirror carriage assemblies
- Vacuum/gas inlet & outlet taps
- Pressure gauge
- Desiccant storage caps
- Purge bellows

A choice of KBr, ZnSe or CaF2 window materials allows users to make the optimum window choice for their applications, and the transfer optics box is equipped with purge ports to allow operation under inert atmospheres. A range of optional features further enhances the flexibility of the Tornado™ range.

Tornado™ Gas Cells

A low-cost range of gas cells for routine analysis at ambient conditions.

Tornado™ T5

- Pathlength (fixed): 1m - 8m
- Pathlength steps: 1m
- Volume: 1.33 litres
- Dimensions (mm): H455 W153 D130

Tornado™ T10

- Pathlength (fixed): 2.1m - 10.6m
- Pathlength steps: 1.06m
- Volume: 2.6 litres
- Dimensions (mm): H470 W153 D146

General specifications

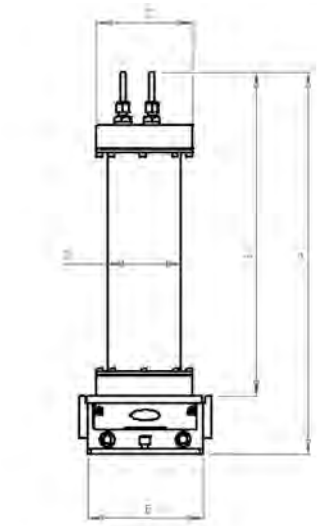
- Cell body material: Borosilicate glass
- Pressure range: Vacuum to 15 psi
- Temperature range: Ambient
- Mirrors: Gold (protected)
- Windows: KBr, ZnSe or CaF2
- Inlet/outlet tubing: 1/4˝
- 'O' rings: Viton™
- Internal components: Anodised aluminium & stainless steel
- Transfer optics: Aluminium mirrors in purgeable optics box
- Cell mount: Benchmark™ series baseplate

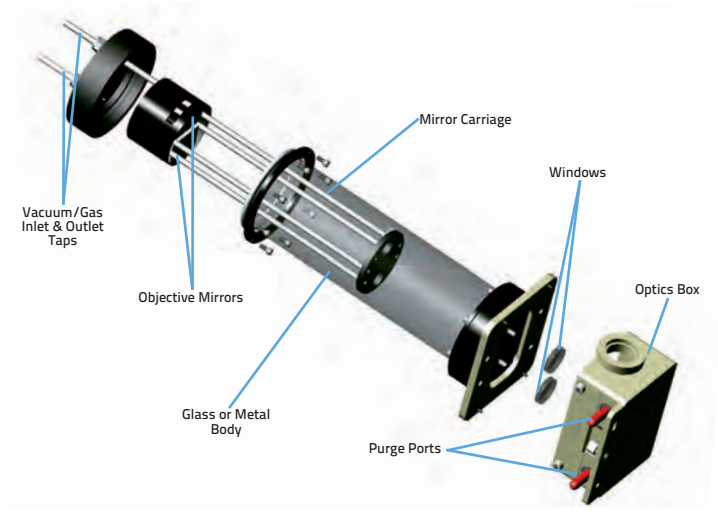
Tornado™ Gas Cells

Heatable long pathlength Gas Cells.

Tornado™ T20

- Pathlength (fixed): 2m - 20m
- Pathlength steps: 2m
- Volume: 4.7 litres
- Dimensions (mm): H675 W153 D146





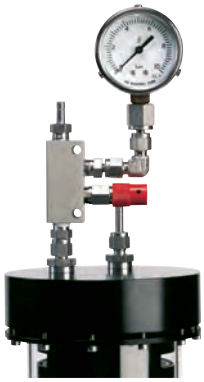
Cell	A	B	C	D	E
T5	455	385	114	86	153
T10	470	400	143	113	153
T20	675	606	143	113	153

All dimensions in mm

Cell	Base Pathlength	Pathlength Range	Volume
T5	25cm	1m to 8m (in 1m steps)	1.33 litres
T10	26.4cm	2.1m to 10.6m (in 1.06m steps)	2.6 litres
T20	0.5cm	2m to 20m (in 2m steps)	4.7 litres

Tornado™ Gas Cells

Optional features.



Optional features

Tornado™ series long pathlength gas cells have been designed with the serious analyst in mind. These high performance, superior quality cells are backed by a range of optional upgrades to further enhance their performance.

Purge Bellows

A pair of purge bellows is available for the Tornado™ series gas cells. These fit between the optics box of the cell and the spectrometer to allow the purging of transfer optics with inert gases such as nitrogen. This feature allows absorbances due to atmospheric H_2O and CO_2 to be eliminated from spectral measurements.

GS10707 Purge Bellows (pair)

Desiccant Storage Caps

These caps are designed to fit over the optical inlet and outlet ports of the Tornado™ series gas cells to seal the transfer optics when the cells are not in use. One of the caps contains a desiccant material, which maintains a dry atmosphere within the transfer optics box and extends the life of KBr windows.

GS24150 Desiccant Storage Caps

Pressure Gauge Kit

A pressure gauge kit is available to fit the Tornado™ series gas cells. Gauges can be specified for low pressure operation (vacuum to 15 psi) and high pressure operation (vacuum to 125 psi - metal bodied cell only). An integral pressure relief valve ensures that cells are automatically depressurised in the event of accidental over pressurisation.

Specac recommend the use of a pressure gauge when operating gas cells at elevated pressures.

GS24160 Pressure Gauge Kit (pair)
(Specify high or low pressure)

Tornado™ Gas Cells compatibility chart

This guide shows which Tornado™ gas cell type can be used within a range of spectrometer sample compartments.

Key: **F** - Fits **DNF** - Does Not Fit

FT-IR Instrument	T5 Cell P/N GS24205	T10 Cell P/N GS24210	T20 Cell P/N GS24220
Bomem M100	F	F	F
Bomem MB100	F	F	F
Bruker IFS66	F	F	F
Bruker Tensor, Vertex, Vector Instruments	F	F	F
Agilent Instruments	F	F	F
Mattson Genesis	F	F	F
Mattson Galaxy	F	F	F
Midac	F	F	F
Nicolet 500, Avatar, Nexus, iS10 Instruments	F	F	F
Nicolet iS5	F	F	F
Perkin Elmer 2000 (GX)	F	F	F
Perkin Elmer Spectrum One, 100, 400, Frontier Instruments	F	F	F
Perkin Elmer Spectrum Two	F	DNF	DNF
Jasco 400/600V, 5000/7000 instruments	F	F	F
Shimadzu 8400, Prestige 21, IRAffinity Instruments	F	F	F

Note: If your spectrometer is not listed, please contact Specac for further details

Tornado™ Gas Cells

Optional features.

Mirror Carriage Assembly

Additional mirror carriages can be specified for use within a single Tornado™ body. This feature greatly enhances the analytical flexibility of the series, and significantly reduces operating costs.

GS24252 **Mirror Carriage Assembly**
(specify model and pathlength)

ordering information

GS24205 **Tornado™ T5**
1m - 8m Long Pathlength Gas Cell

GS24210 **Tornado™ T10**
2.1m - 10.6m Long Pathlength Gas Cell

GS24220 **Tornado™ T20**
2m - 20m Long Pathlength Gas Cell

Fixed pathlengths available

Tornado™ T5 - 1, 2, 3, 4, 5, 6, 7, 8m
Tornado™ T10 - 2.1, 3.2, 4.2, 5.3, 6.3, 7.4, 8.5, 9.5 &10.6m
Tornado™ T20 - 2, 4, 6, 8, 10, 12, 14, 16, 18 & 20m

Tornado gas cell configuration step by step

1) Choose the size of gas cell with its part number eg for Tornado T5 cell the P/N would be GS24205
2) Choose body type from Glass (G) or Metal (M)
3) Choose the window material from KBr (K), CaF2 (C) or ZnSe (Z).
4) Specify a fixed pathlength from those available for the cell size
5) If required choose a Low (L) or High (H) pressure gauge kit to be fitted

Example: P/N GS24205GCFV would be for a Cyclone C5 cell with a glass body, CaF2 windows, fixed pathlength, Viton O-rings and no pressure gauge

For all Gas Cells please specify Spectrometer make and model to include provision of the appropriate Benchmark™ baseplate for installation

(Please note: KBr windows cannot be used with a metal bodied cell)

Options

GS10707 **Purge Bellows** (pair)
GS24150 **Desiccant Storage Caps**
GS24152 **Mirror Carriage Assembly** for Tornado™ series gas cells
(specify model & pathlength)

GS24160 **Pressure Gauge Kit**
To fit Cyclone™ and Tornado™ gas cells
(specify model & high or low pressure)

GS24161 **Vacuum/Gas Inlet & Outlet Taps**
with push-on connectors for Tornado™ series gas cells

GS24206 **Tornado Gas Cell T5 ESK**
GS24207 **Tornado Gas Cell T10, T20 ESK**

Replacement windows

GS24153 **Replacement KBr windows**
for Tornado™ and Cyclone™ series gas cells
(specify model)

GS24154 **Replacement ZnSe windows**
for Tornado™ and Cyclone™ series gas cells
(specify model)

GS24155 **Replacement CaF2 windows**
for Tornado™ and Cyclone™ series gas cells
(specify model)

Transmission Cells

A wide selection of transmission cells

Transmission cells for the analysis of solid samples in UV, Vis and IR by means of optical spectroscopy.

These sampling cells are available for ambient temperature analysis as well as high temperature and/or high pressure spectroscopic analysis.

High Temperature/High Pressure Cell

In-situ analysis under extreme conditions.

Figure 1 - Transmission analysis mode

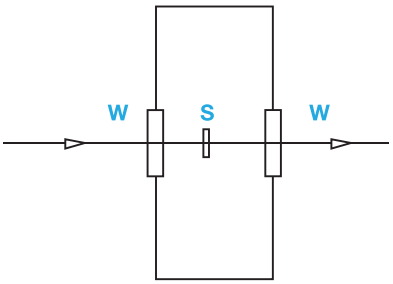


Figure 2 - Reflectance analysis mode

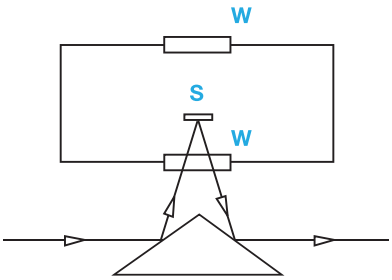
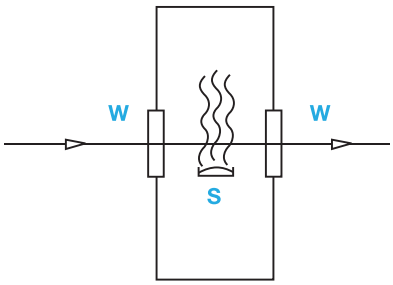


Figure 3 - Decomposition analysis mode



High Temperature/High Pressure Cell

High technology products and modern industrial processes require in-situ analysis under extreme conditions of temperature and pressure.

The ability to recreate these conditions and spectroscopically analyse samples or monitor processes in the laboratory is provided by the Specac High Temperature/High Pressure Cell.

The cell has been designed for high optical throughput and allows simple interchange between its multi-purpose analysis configurations, Transmission, Reflectance and Decomposition (See figures 1, 2 and 3). Key: S = Sample W = Window

Key features

- **Extreme Condition Spectroscopy** - programmable controlled temperatures up to 800°C and pressures from vacuum to 1000 psi
- **Multi-purpose Analyzer** - transmission, specular reflectance and decomposition
- **Optimised Design** - permits easy interchange between analysis modes
- **Safe and reliable construction** - rugged, durable construction incorporating safety approved electronics and safety burst disc

Applications

- Component failure
- Decomposition studies
- In-situ reaction monitoring
- Surface emissivity measurements
- Process gas analysis

High Temperature/High Pressure Cell

The High Temperature/High Pressure Cell permits analysis of solid samples in transmission, specular reflectance and decomposition modes; and process gases in static or flow transmission mode. Sample temperatures of up to 800°C can be achieved and the cell can operate at pressures from vacuum to 1000 psi

The cell windows and body are separately heated and controlled up to 200°C to prevent condensation of evolved materials adhering to the ZnSe windows. Water cooled top and bottom blocks prevent undue heating of the spectrometer sample compartment and maintain accessible surfaces at a safe temperature.

Switching between transmission (maximum sample diameter 13mm) and specular reflectance modes is achieved by changing an optical pressurised window assembly on the cell body and fitting to an alternative baseplate.

The decomposition mode is obtained by a simple repositioning of the sample holder/heater assembly which places the heated sample in a pan just below the optical beam. Gases evolved from the sample at different temperatures can then be analysed. The cell has provision for a steady gas flow for either gas analysis or purging. The cell volume is 80ml.

Cell temperature is regulated using a dedicated controller that can be programmed manually or through a computer. The design incorporates a number of important safety features. In particular, all electrical supplies to the cell comply to Canadian Standards Association (CSA) regulations (30 volts or less) and the temperature controllers are equipped with open circuit detection on the thermocouple inputs to prevent overheating.

The cell itself is fitted with a burst disk to prevent inadvertent over pressurisation and, if necessary, this can be piped to a fume cupboard or other outlet point.The cell as standard is ruggedly constructed from durable 316 stainless steel and can be disassembled for thorough cleaning if required.

ordering information

Specifications

Body **Stainless steel**
Window **ZnSe**
Seals **Silicone**
Note: check that your chemicals are compatible with these standard specs

GS05850 **High Temperature/High Pressure Cell**
Includes: Optical unit with ZnSe windows and instrument baseplate, transmission/decomposition sample holder, programmable high stability temperature controller.
Please specify spectrometer make and model.

GS05855 **Advanced High Temperature/High Pressure Cell System**
Includes: Optical unit with ZnSe windows and instrument baseplate, transmission/decomposition sample holder, reflectance mode wedge pressurised window assembly and reflectance mode baseplate, programmable high stability temperature controller.
Please specify spectrometer make and model.

GS05860 **Reflectance mode kit**
Consists of a kit of parts to convert a GS05850 HTHP cell to a fully advanced HTHP cell as supplied under GS05855

GS05865 **Replacement Seal kit**
GS05867 **Replacement ZnSe cell windows** (tested and certified)
GS05868 **Decomposition Pans** - spare set (2 off)
GS05869 **Replacement 'Burst-Disk'**

Options

GS05870 **HTHP Cell ESK**
GS28000 **RS232 Connection kit**
GS28001 **USB Connection kit**
GS28002 **RS485 Connection kit**

DC-3 Diamond Compression Cell

A Universal Diamond Compression Cell specially designed for FT-IR microscopes and the Specac Microfocus Beam Condenser.

DC-3 Diamond Compression Cell

The DC-3 diamond compression cell enables samples to be compressed to an ideal thickness for transmission experiments. It uses two type single crystal diamond windows, each mounted into a Hastelloy plate. The clear aperture of 1.5 mm diameter provides excellent signal throughput when positioned at the beam focus of an FT-IR spectrophotometer using an MCT detector. For optimum performance with a DTGS detector, the Microfocus Beam Condenser P/N GS02560 (with ZnSe lenses) or P/N GS02561 (with KRS-5 lenses) is recommended to be used with the DC-3 in order to obtain high quality spectra.

The DC-3, because of its small size and shape can also be used with Infrared Microscopes, where the large aperture allows for more than one sample to be loaded and compressed at one time. Each individual sample could then be selectively moved into the light beam from the IR microscope, saving on the time needed to mount and prepare each sample between analyses.

Key features

- Single crystal flat diamond windows
- Large clear aperture 1.5mm
- Hastelloy body construction (3" x 2" x 9/16", 76.2 x 50.8 x 14.3mm)
- Universal use with FT-IR microscopes and
- Microfocus Beam Condenser
- High working pressure, high throughput

Applications

- Compression to optimum transmission thickness of polymers, rubbers and minerals
- Microanalysis of brittle, elastic semi-rigid fibres, particles and fragments

ordering information

GS02555 **DC-3 Diamond Compression Cell**

Options

GS02556* Diasqueeze Plus Kit with ZnSe lenses

GS02557* Diasqueeze Plus Kit with KRS-5 lenses
Includes: DC-3 Diamond Compression Cell
Microfocus Beam Condenser Forceps
Stainless steel sample needle
Sample preparation knife Blades (10)
Blade remover (2)

GS02560* Microfocus Beam Condenser-ZnSe Lenses

GS02561* Microfocus Beam Condenser-KRS-5 Lenses

GS02570 KRS-5 lens kit for use with Microfocus Beam Condenser

GS02571 ZnSe lens kit for use with Microfocus Beam Condenser

Spares and consumables

GS02508 Sample forceps

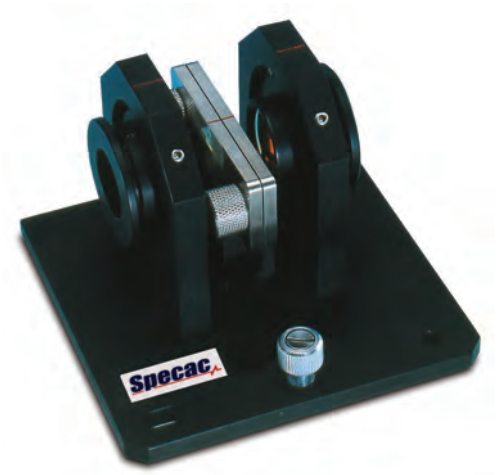
GS02509 Stainless steel sample needle

GS02510 Sample preparation knife with blades (10) and blade remover

***Please specify spectrometer make and model.**

Microfocus Beam Condenser

A rugged, high performance 4x Beam Condenser specially designed for use with the DC-3 Diamond Compression Cell.



Microfocus Beam Condenser

The Microfocus Beam Condenser is a high performance 4x beam condenser specially designed for use with the DC-3 Diamond Compression Cell (P/N GS02555). The simple two lens linear optical system ensures easy alignment and high throughput over a wide working wavelength range. The Microfocus beam condenser can be supplied with either ZnSe lenses (P/N GS02560) or with KRS-5 lenses (P/N GS02561). (KRS-5 allows an extended mid-infrared range to circa 350 cm-1).

Lens upgrade kits (P/N GS02570 KRS-5 lens kit, P/N GS02571 ZnSe lens kit) are available should you wish to change from one version to the other.

The Microfocus Beam Condenser is optically matched for the DC-3 Diamond Compression Cell (P/N GS02555), which locates accurately and reproducibly in the beam condenser using spring ball catches. The whole accessory combination (DC-3 in the Microfocus beam condenser) is mounted into a spectrometer sample compartment via a standard Specac Benchmark™ baseplate. This allows for optimum stability in all FT-IR spectrometers.

ordering information

GS02560 **Microfocus Beam Condenser** ZnSe
Please specify spectrometer make and model

GS02561 **Microfocus Beam Condenser** KRS-5
Please specify spectrometer make and model

GS02570 Microfocus Beam Condenser KRS-5 Lens Kit

GS02571 Microfocus Beam Condenser ZnSe Lens Kit

GS02508 Sample forceps

GS02509 Stainless steel sample needle

GS02510 Sample preparation knife with blades (10) and blade remover

Micro Compression Cell

The Specac Micro Compression Cell is intended for soft solid or semi liquid sample analysis by FT-IR transmission or infrared microscopy.

Micro Compression Cell

The Specac Micro Compression Cell is intended for soft solid or semi liquid sample analysis by FT-IR transmission or infrared microscopy. The cell allows for samples to be compressed and flattened between two non-rotating transmission windows for analysis. It is supplied with a choice of NaCl or KBr windows as standard, but CaF2, BaF2, and ZnSe windows are also available. The cell is mounted to a standard spectrophotometer 3" by 2" slide mount for ease of use in a broad range of optical spectrometers.

With a clear aperture of 7.0 mm diameter, the Specac Micro Compression Cell allows for a good signal when placed at the sampling focus of a standard FT-IR spectrometer. Alternatively, the Micro Compression Cell can also be used with an infrared microscope, where the large aperture allows for more than one sample to be loaded at one time.

Key features

- Uniform pressure applied across sample
- Non rotating windows
- 7.0 mm clear aperture
- Choice of window materials
- Standard 3" by 2" slide mount

ordering information

GS02520 **Micro Compression Cell**
(With choice of NaCl or KBr windows)

Micro Compression Cell Windows

GS09070 NaCl windows circular 13mm dia (pair)

GS09071 KBr windows circular 13mm dia (pair)

GS09072 CaF2 windows circular 13mm dia (pair)

GS09073 BaF2 windows circular 13mm dia (pair)

GS09076 ZnSe windows circular 13mm dia (pair)

Oil in Water Analysis Kit

For the analysis of total recoverable oil and grease or petroleum hydrocarbons in water.

Key features

- Matched transmission cell pairs
- Large aperture to avoid scattering of IR beam
- Stoppered
- Three different pathlengths: (10mm, 50mm, 100mm)
- Transmission range approximately 40,000cm^{-1} to 2,700cm^{-1}
- Slide mounted holder

ordering information

GS08900	**Oil in Water Analysis Kit**
	Includes:
GS08901	Matched pair of 10mm pathlength rectangular infrared quartz cells
GS08902	Matched pair of 50mm pathlength cylindrical infrared quartz cells
GS08903	Matched pair of 100mm path length cylindrical infrared quartz cells
GS08904	Slide mounted holder

Oil in Water Analysis Kit

The Oil In Water Analysis Kit enables the analysis of total recoverable oil and grease or petroleum hydrocarbons in water using a new method of analysis D7066-04 approved by the ASTM (American Society for Testing and Materials).

The existing standard EPA methods 413.2 and 418.1 have been replaced as they called for use of Freon as the extraction solvent for the recovery of oil and grease within a water sample.

Freon is now banned from usage as it is an Ozone depleting chemical and harmful to the environment. The D7066-04 method is very similar to the EPA methods but the Freon solvent is replaced by use of the dimer/trimer of chlorotrifluoroethylene (C2ClF3). This solvent is known commercially as S-316 available as an IR spectroscopy grade solvent.

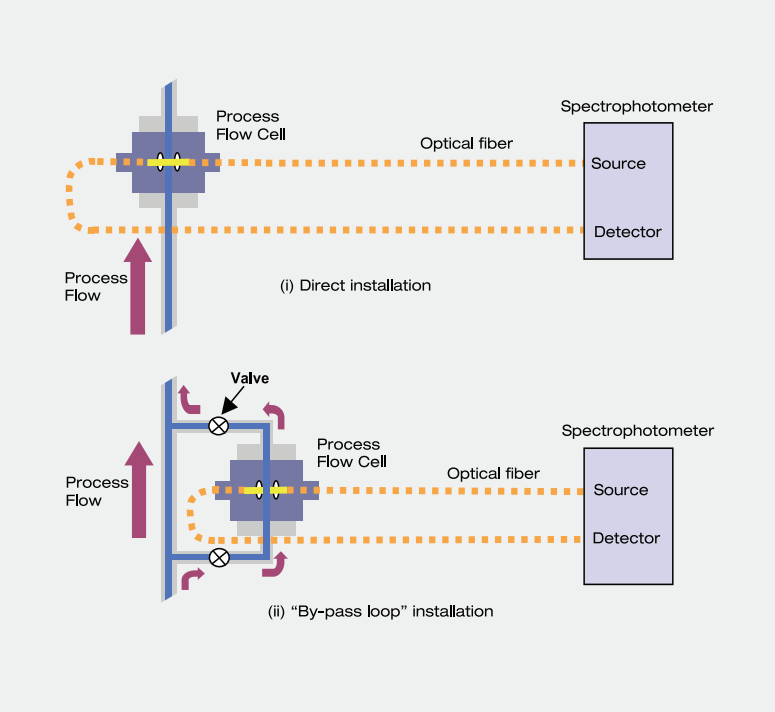
The ASTM D7066-04 method can be purchased from the American National Standards Institute (ANSI). Go to their website page www.webstore.ansi.org and search for the method D7066-04. The method describes the procedure for testing and lists the relevant equipment and chemicals needed. (Specac does not provide this equipment or chemicals.)

The Oil in Water Analysis Kit from Specac contains matched pairs of infrared grade quartz cells supplied in three different pathlengths of 10mm, 50mm and 100mm. They are all stoppered to ensure retention of volatile materials in the samples. The cells have large filling ports to ensure quick and efficient sample introduction and removal. Matching of the cells ensure precise, repeat measurements.

The cells are placed into the spectrometer via the particular 3" x 2" mounting holder supplied.

Specac Process Capabilities

A proven track record of reliability and robustness in the most demanding industrial environments.



ProCell™ Process Flow Cells

Specac have over 15 years of process application experience. Our ProCell™ process flow cells are designed to withstand the rigors of process and environmental conditions while maintaining continuous measurement stability and have a proven track record of reliability and robustness in the most demanding industrial environments.

- Process cells are a key enabling technology to facilitate the acquisition of continuous online UV/Vis and NIR spectroscopic absorbance process measurements

Process flow cells are typically installed as part of the process circuit either directly in the process stream or as a "by-pass loop".

- By adopting the process flow cell in a "by-pass loop" configuration, the user has the opportunity to isolate the process flow cell from the process cell for routine cleaning, servicing, or calibration.

Computer-aided optical design ensures that Specac's process flow cells have the highest levels of optical throughput to ensure the best quality of spectroscopic data.

Specac process cells are customized to ensure exact matching with the client's process requirements.

- Material metallurgies, seal types, and window materials are chosen to be compatible with the chemical and environmental needs of the application. This often goes beyond standard operating conditions, and includes aggressive cleaning regimes and extreme weather conditions.
- Optical designs are configured for the UV/Vis or NIR spectral regions as appropriate, and optical pathlengths are set to ensure optimum spectral absorbance of the target chemical species.
- A range of pipe fittings and flange connections are available to interface the process flow cell with the process pipe work.
- Cleaning ports and seal leak warning ports can also be integrated into the cell design.

Process Cells

Page 92
ProCell™ Cascade

Page 92
ProCell™ Vortex

Page 93
ProCell™ Typhoon

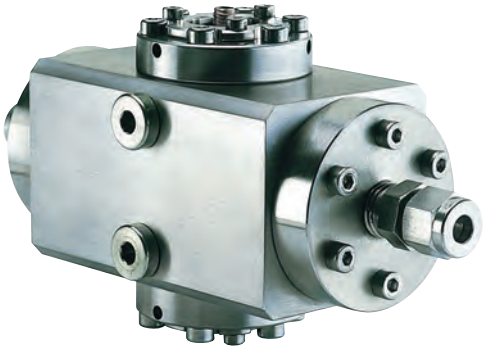
Unique fibre-optic coupled NIR Process Cells

A broad range of fibre-optic coupled NIR Process Cells are available from Specac for on-line liquid, gas, or vapour phase NIR spectroscopic transmission analysis under process conditions.

These transmission cells have SMA optical fibre interfaces for connection to appropriate FTIR or optical spectrometers to facilitate on-line in-situ spectroscopic transmission analysis in real time.

ProCell™ Cascade

Liquid phase process flow cell.



ProCell™ Cascade

The Specac ProCell™ Cascade liquid phase process cell is a rugged transmission mode cell ideally suited for optical sampling of industrial fluids. The ProCell™ Cascade series is designed to be pipe-mounted into the sample analysis part of the process steam or in a by-pass.

Key features

- Optical transmission pathlengths are available from 1.0 to 10 mm to optimise UV/Vis or NIR spectroscopic absorption features for analysis.
- Capability for high temperature applications (up to 400°C)
- Can be configured for a wide range of ANSI and
- DIN flange sizes
- Cleaning port option for in-situ servicing

ProCell™ Vortex

Liquid phase process flow cell

ProCell™ Vortex

The Specac ProCell™ Vortex liquid phase process cell is an extremely robust cell that delivers optimum sensitivity to process characteristics.

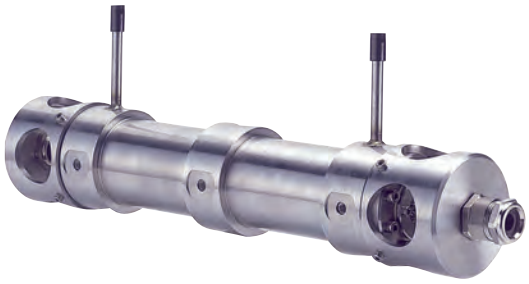
The ProCell™ Vortex series is designed to be flange mounted directly into the process stream or in a by-pass.

Key features

- Optical transmission pathlengths are available from 1.0 to 10 mm to optimise UV/Vis or NIR spectroscopic absorption features for analysis.
- Capability for high temperature applications (up to 400°C)
- Can be configured for a wide range of ANSI and
- DIN flange sizes
- Cleaning port option for in-situ servicing

ProCell™ Typhoon

Gas/vapour phase process flow cell.



ProCell™ Typhoon

The Specac ProCell™ Typhoon is a rugged pipe-mounted spectroscopic transmission cell for gas phase process monitoring in the UV/Vis or NIR region. The ProCell™ Typhoon is typically fitted into the process stream or in a by-pass using Swagelok connectors.

Sapphire windows give outstanding abrasion and chemical resistance, in addition to the ability to withstand severe thermal shock (e.g. high pressure steam cleaning).

Key features

- To ensure optimum UV/Vis or NIR spectroscopic absorption features for pathlengths are available at 20cm, 30cm, or 50cm.
- Cleaning ports allow the internal cell windows to be cleaned without removing the cell from the pipe work in the event of fouling (either from long term use or following a process upset)
- Optical fibre connectivity is ensured by industry standard SMA 905 connectors
- Anti-extrusion seal design to give high pressure capability and long-term reliability

ordering information

Please contact Specac for further details.

Polarizers in sample analysis

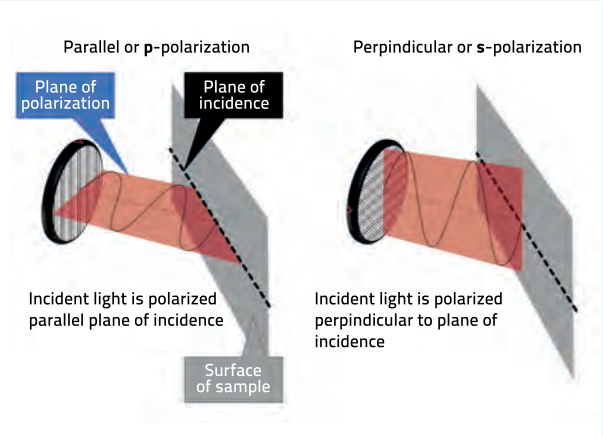
SPECAC APPLICATION NOTE

To those with an interest in photography, polarization will be familiar as a method for eliminating specular reflections from the surface of water or glass, bringing out subsurface details in stunning clarity. However, in industrial applications polarisation is often neglected.

Polarized light is useful because it enables selective measurement of samples that either alter the polarization state of the incident beam, or preferentially absorb one polarization of light over another; the former is the basis of ellipsometry and polarimetry techniques (among others), the latter is the basis of many infrared spectroscopic measurements with polarized light.

Parallel & perpendicular polarizers

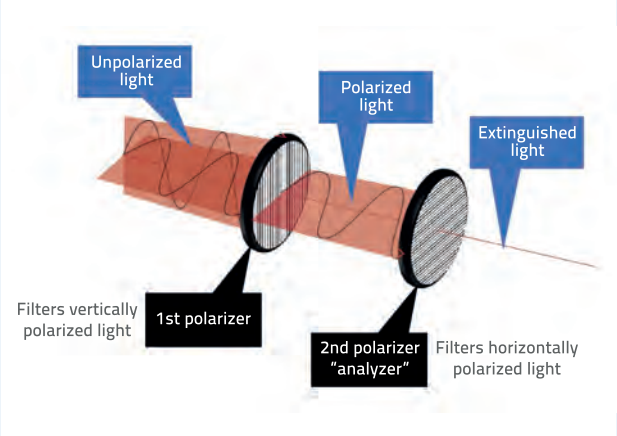
Linearly polarized light has its electric field confined to a plane. When this vector is aligned with the plane of incidence (the plane containing the incident, reflected, and transmitted rays at an interface) the light is said to be parallel, or p-polarized; when the vector is normal to the plane of incidence, the light is said to be perpendicular, or s-polarized.



Anisotropy within samples can easily be explored by measuring alternately with parallel and perpendicularly polarized light and comparing the responses.

Crossed polarizers

Two polarizers with their grids oriented at 90° to one another are said to be 'crossed'. This configuration should completely extinguish any light passing through the pair, since the first polarizer will filter out all polarizations capable of passing the second. If a sample placed between them alters the polarization state of the beam, then some light will pass the analyzer.



The analyzer can then be rotated until the beam is extinguished again and the necessary rotation angle is then recorded as the particular polarization change induced by the sample.

Spectroscopy applications of infrared polarizers

Absorption of a polarized beam is maximized when its electric field is parallel to the electric dipoles in the sample.

For a sample material where all molecular dipoles are oriented in the same direction, varying the polarization angle will yield minimum and maximum intensities for a given absorbance. This gives information on the orientation of those molecules with respect to the beam.

This is the key to many applications of polarizers.

Polarizers

Precision polarizers in a range of materials

Holographic infrared wire grid polarizers are available from Specac for use in the IR range from 2 - 35 µm (or 5000 - 285 cm^{-1}).

These polarizers consist of a wire grid polarizer structure imprinted in a photoresist layer on an infrared transmitting substrate such as calcium fluoride (CaF2), barium fluoride (BaF2), zinc selenide (ZnSe), germanium (Ge), or thallium bromoiodide (KRS-5).

Wire grid polarizers for infrared applications

Specac manufacture two types of wire grid polarizer: holographic wire grids for mid-infrared applications, and free-standing wire grids for far-infrared and millimetre wave applications.

Free Standing Wire Grid Polarizers

The simplest form of wire grid consists of micrometer diameter wire wound continuously round a metal former. There is no substrate material, so the performance of the polarizer is affected purely by the diameter and spacing of the wires.

Free standing wire grid polarizers are used as polarizing beam splitters for interferometry (such as the Martin-Puplett interferometer) and for polarization studies in far-infrared and terahertz spectroscopy of materials.

Holographic Wire Grid Polarizers

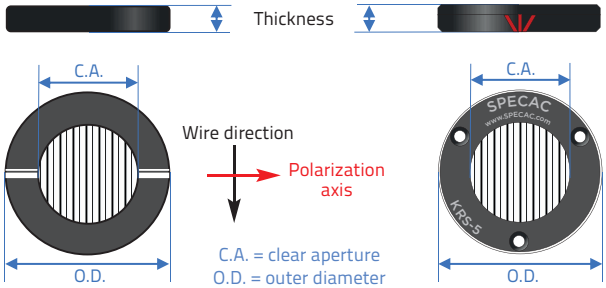
In order to achieve finer grid spacing, laser holography is used to generate a sinusoidal interference pattern on an infrared-transmitting substrate. A metallic coating is applied along the peaks of this pattern, resulting in an array of parallel strips. With this method spacings as small as 250nm are achieved. The overall transmission is affected by the choice of substrate material.

Holographic wire grid polarizers are used for spectroscopic polarization studies, thermography, and as filters. Used both by chemists and by physicists, substrates are available with good transmission and extinction characteristics across both the mid-wave (3-5µm) and long-wave (8-12µm) atmospheric windows, as well as the classic mid-infrared range (4000-400cm^{-1}) covered by Fourier-transform Infrared spectrometers.

Mounting configurations

Specac offer mountings for holographic wire grid polarizers. Benchmark™ mountings are compatible with selected FTIR spectrometer accessories and can be supplied with a rotatable holder.

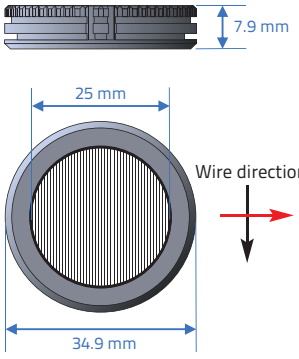
Standard configurations



Standard optical mounting configuration

Ring mounting with equi-spaced 2.8mm dia. fixing holes

Benchmark™ configurations



Benchmark™ mounting configuration

Benchmark™ 3" x 2" Slide Mounted Polarizer Rotator Mounting GS12500

The wire direction (black indicator arrow) is the plane in which polarized radiation is reflected or absorbed in the wires; the polarization axis (red indicator arrow) is the plane in which the radiation is transmitted.

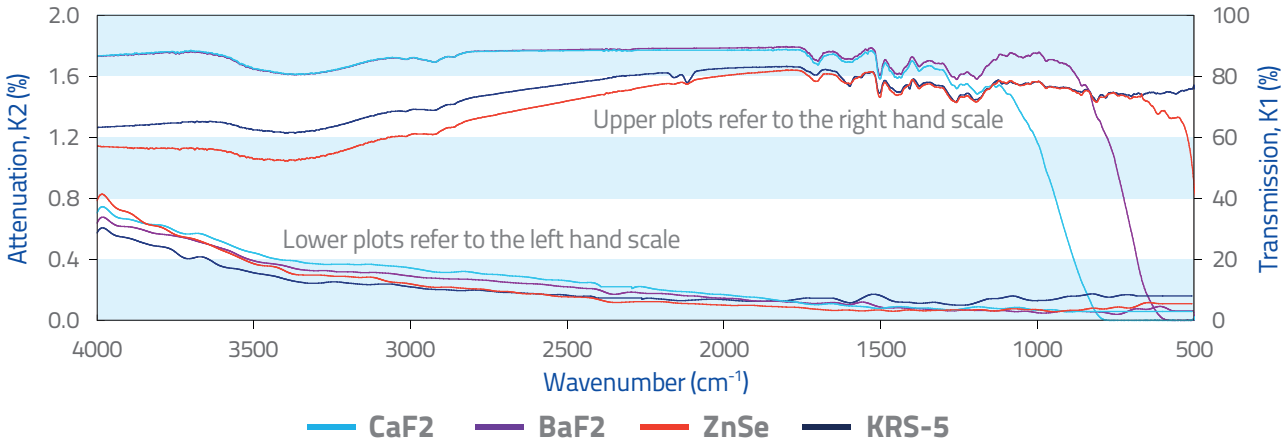
Opto-Physics

Holographic wire grid polarizers - GS57500 series

Our range of polarizers for common mid-infrared optics and spectroscopy applications are available in industry standard 25mm and 50mm outer diameter ring mounts. They have excellent transmission and extinction characteristics across the whole mid-infrared region.

Substrate Transmission window		KRS-5 2-35µm	CaF2 1-10µm	BaF2 1-12µm	ZnSe 1-15µm
Typical extinction ratio	@ 5µm @ 10µm	>300:1 >300:1	>300:1 >300:1	>300:1 >400:1	>300:1 >400:1
Substract thickness		2mm for 25mm O.D. 4mm for 50mm O.D.			
Surface flatness	@ 588nm	2λ	λ		
Parallelism		5 arcmin	3 arcmin		
Normal wire pitch		0.40µm			

Typical Transmission (K1) and attenuation (K2) Plots for Specac Opto-Physics polarizers (See graph below)



ordering information

	Standard optical mounting	
Outer diameter (mm)	25	50
Clear aperture (mm)	18	34
Thickness (mm)	5	6

KRS-5	GS57500	GS57504
CaF2	GS57501	GS57505
BaF2	GS57502	GS57506
ZnSe	GS57503	GS57507

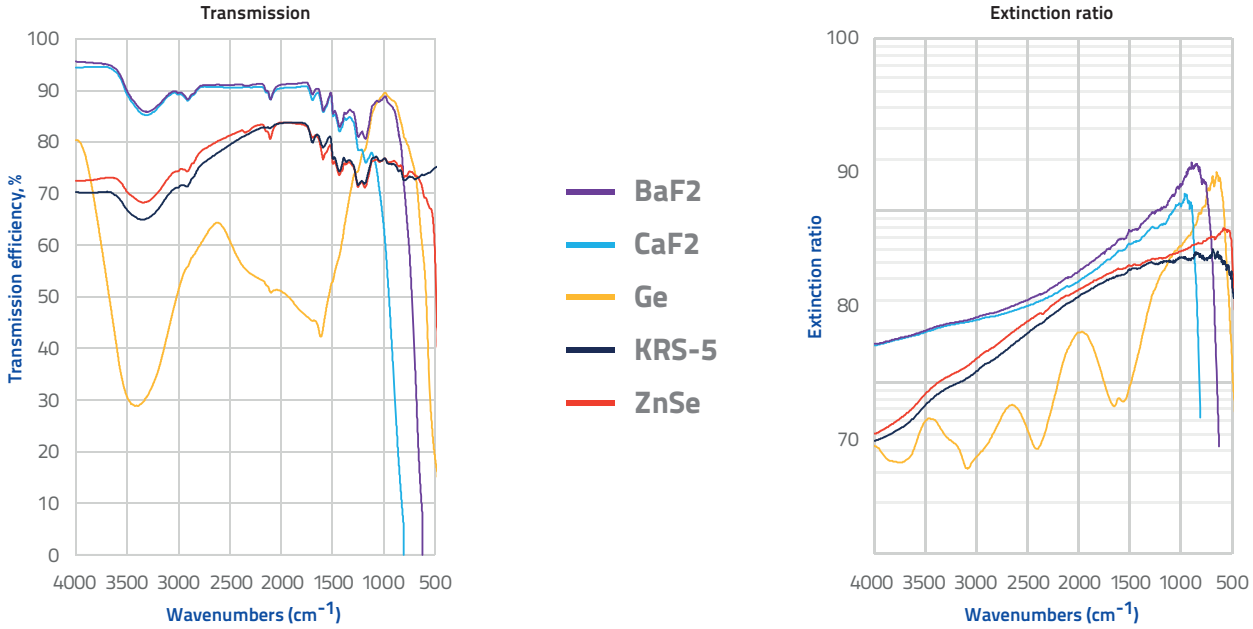
Specac brilliant spectroscopy

Benchmark™ FTIR & Ring Mounted

Holographic wire grid polarizers

Holographic wire grid polarizers configurable for both optical and spectroscopy benches. Benchmark™ FTIR polarizers fit directly into the aperture ports of selected Benchmark™ baseplate accessories.

Substrate Transmission window		KRS-5 2-35µm	CaF2 1-10µm	BaF2 1-12µm	ZnSe 1-15µm	Ge 8-12µm
Typical extinction ratio	(3-5µm) (8-12µm)	>80:1 >450:1	>200:1	>200:1 >1000:1	>100:1 >500:1	>300:1
Typical transmission	(3-5µm) (8-12µm)	>65% >70%	>80%	>80% >80%	>65% >70%	>70%
Substract thickness		2mm for 25mm C.A.	4mm for 38mm & 50mm C.A.		5mm for 71mm C.A.	
Surface flatness	@ 588nm	2λ	λ			
Parallelism		5 arcmin	3 arcmin			
Normal wire pitch		0.25µm				0.40µm



ordering information

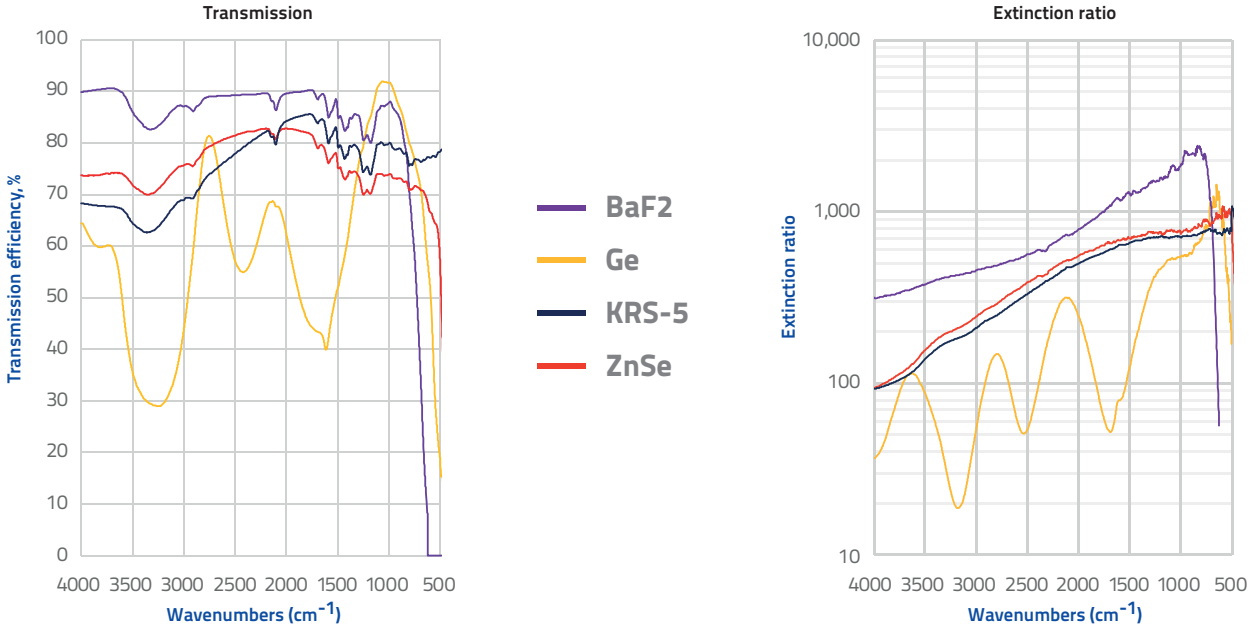
	Benchmark™ FTIR	Ring mounting				Unmounted
Outer diameter (mm)	34.9	41	55	70	90	25
Clear aperture (mm)	25	25	38	50	71	25
Thickness (mm)	7.9	6.7	8.7	8.7	9.7	2
KRS-5	**GS12000**	GS57010	GS57012	GS57014	--	GS57001
Ge	**GS12700**	GS57070	GS57072	GS57074	GS57076	GS57003
CaF2	**GS12800**	GS57080	GS57082	GS57084	GS57086	GS57006
BaF2	**GS12900**	GS57090	GS57092	GS57094	GS57096	GS57008
ZnSe	**GS12950**	GS57050	GS57052	GS57054	GS57056	GS57016

High Extinction Ratio (HER)

Holographic wire grid polarizers

Manufactured for superior rejection of the parallel polarization, at the expense of slightly reduced transmission of the perpendicular polarization. This results in a higher extinction ratio, especially at longer wavelengths.

Substrate Transmission window		KRS-5 2-35µm	CaF2 1-10µm	BaF2 1-12µm	ZnSe 1-15µm	Ge 8-12µm
Typical extinction ratio	(3-5µm) (8-12µm)	>150:1 >700:1	>400:1	>400:1 >1400:1	>150:1 >700:1	>400:1
Typical transmission	(3-5µm) (8-12µm)	>60% >70%	>80%	>80% >75%	>70% >70%	>80%
Substract thickness		2mm for 25mm C.A.	4mm for 38mm & 50mm C.A.		5mm for 71mm C.A.	
Surface flatness	@ 588nm	2λ	λ			
Parallelism		5 arcmin	3 arcmin			
Normal wire pitch		0.25µm				0.40µm



ordering information

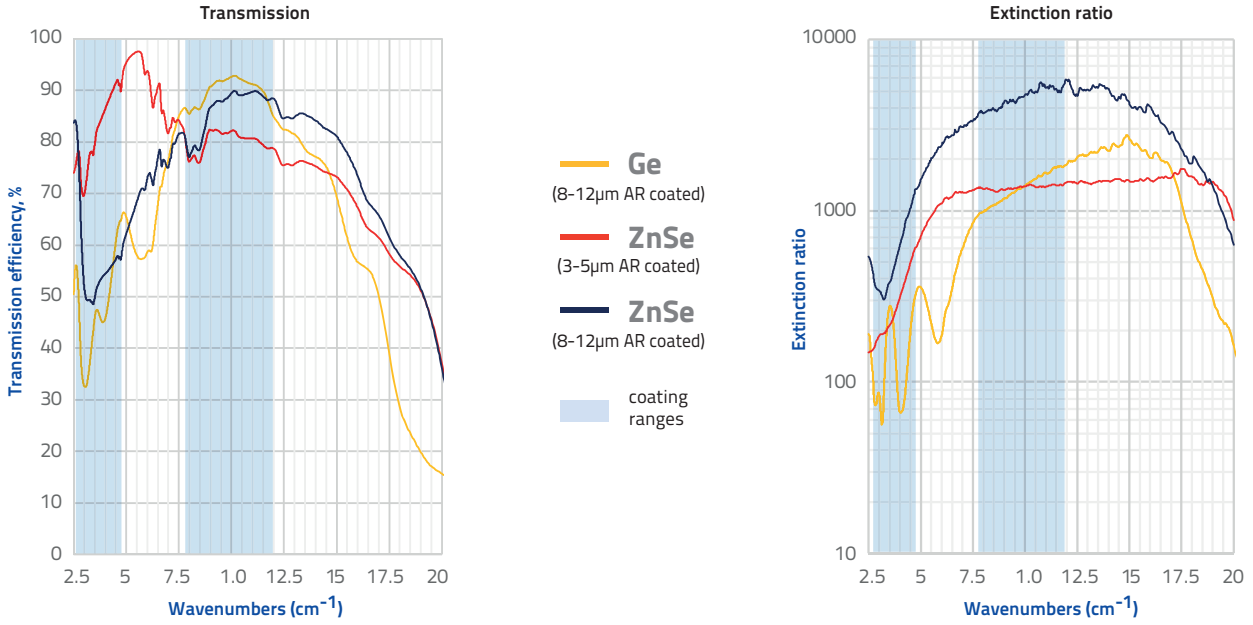
	Ring mounting				Unmounted
Outer diameter (mm)	41	55	70	90	25
Clear aperture (mm)	25	38	50	71	25
Thickness (mm)	6.7	8.7	8.7	9.7	2
KRS-5	GS57011	GS57013	GS57015	--	GS57002
Ge	GS57071	GS57073	GS57075	GS57077	GS57004
CaF2	GS57081	GS57083	GS57085	GS57087	GS57007
BaF2	GS57091	GS57093	GS57095	GS57097	GS57009
ZnSe	GS57051	GS57053	GS57055	GS57057	GS57017

Image Quality (IQ)

Holographic wire grid polarizers

With flatter and more parallel substrates and anti-reflection coatings, these polarizers are ideal for infrared imaging applications sensitive to optical aberrations.

Substrate		Ge	ZnSe	ZnSe
Typical extinction ratio	(3-5µm) (8-12µm)	>1000:1	>150:1 >1000:1	>300:1 >3000:1
Typical transmission	(3-5µm) (8-12µm)	>80%	>70% >75%	>45% >75%
Substract thickness		2mm for 25mm C.A.	4mm for 38mm & 50mm C.A.	5mm for 71mm C.A.
AR coating		8-12µm	3-5µm	8-12µm
Surface flatness	@ 588nm	λ/4		
Parallelism		1 arcmin		
Nominal wire pitch		0.40µm	0.25µm	

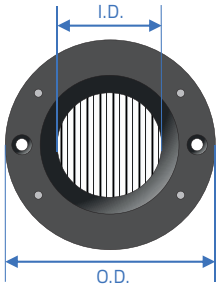


ordering information

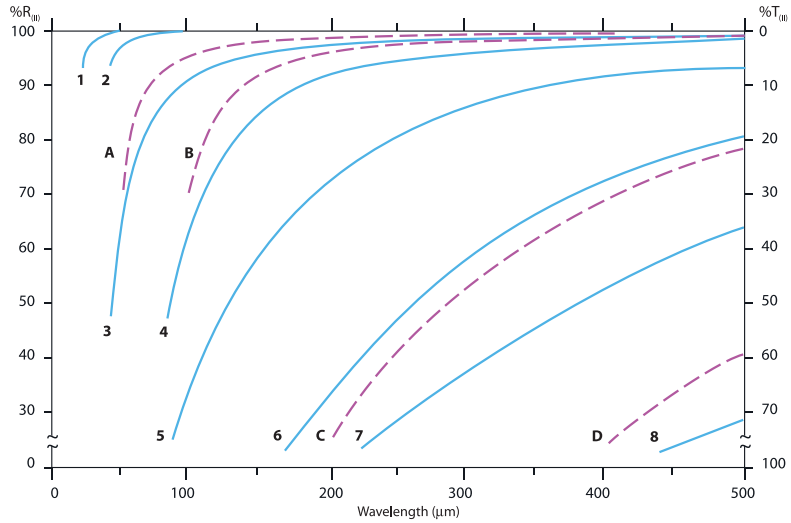
		Ring monitoring		
Outer diameter (mm)	41	55	70	90
Clear aperture (mm)	25	38	50	71
Thickness (mm)	6.7	8.7	8.7	9.7
Ge (8-12µm)	GS57078	GS57079	GS57068	GS57069
ZnSe (8-12µm)	GS57059	GS57061	GS57063	GS57065
CaF2 (8-12µm)	GS57058	GS57060	GS57062	GS57064

Free Standing Wire Grid Polarisers

Suitable for use at longer wavelengths in the far infrared and millimetre wave region. A range of material and mounting configurations are available as standard, with others available on request.



Transmission characteristics of free standing wire grid polarizers showing effect of wire diameter and period.



Curve	Wire dia. (µm), a	Period (µm), d	a/d
1	5	12.5	0.4
2	10	25	0.4
3	5	25	0.2
4	10	50	0.2
5	5	50	0.1
6	10	100	0.1
7	5	100	0.05
8	10	200	0.05
A	5	25	0.2
B	10	50	0.2
C	5	100	0.05
D	10	200	0.05

Note: Curves A - D = 45° incidence (rotated about wire direction)

ordering information

Grid	Nominal dimensions	Grid specification[1]			Frame dimensions[2]			Mounting configuration
	Wire spacing	12.5µm	25µm	50µm				
	Wire thickness	5µm	10µm	10µm				
	Aspect ratio	0.4	0.4	0.2	O.D.	I.D.	Thickness	
Part no.s		GS57200	GS57201	--	50mm	25mm	12mm	Two 3.5mm fixing holes
		GS57202	GS57203	--	80mm	50mm	12mm	Two 3.5mm fixing holes
		GS57204	GS57205	--	105mm	75mm	12mm	Two 3.5mm fixing holes
		GS57206	GS57207	--	130mm	100mm	12mm	Two 3.5mm fixing holes
		--	GS57100	GS57110	140mm	120mm	12.7mm	Two 3.5mm fixing holes (counterbored)
		GS57135	GS57130	--	133.25mm	95.25mm	12.7mm	To fit NPL cube-type interferometer

[1] Tungsten wire is used as standard [2] Frames are manufactured in anodized aluminium as standard Other materials are available on request

Rotatable Polarizer Mounts & Kits

The Benchmark™ FTIR series polarizer configurations can also be supplied as a kit with a slide-mounting rotation device.

P/N GS12500

P/N GS12510

GS12500 Rotator Mount

for GS12000 Series Polarizers

The Polarizer Mount GS12500 is a rotatable 3" x 2" slide mount for use with the GS12000 series of FT-IR Infrared polarizers. This mount quickly and easily fits in to any spectrometer. This polarizer mount has an adjustable, rotatable ring that is marked with angular degree divisions. This allows for any GS12000 series polarizer to be accurately positioned for polarized radiation over the range from 0° (perpendicular) through to 90° (parallel) transmitted radiation in 5° graduated marks.

GS12510 Benchmark™ Mount

for GS57010 Series Polarizers

The Polarizer Mount GS12510 is a rotatable mount that is attached directly to the aperture ports of any optical unit used with Specac Benchmark™ baseplate compatible accessories. Such accessories include the Golden Gate® and Gateway™ horizontal ATR systems.

The polarizer mount GS12510 accepts the Specac 38mm C.A. range of GS57010 Series, Standard Infrared polarizers. When a polarizer has been installed into the mount, it can be rotated for a particular angular degree of polarized light by adjustment of an outer rotating ring on the polarizer mount itself.

ordering information

Polarizer Rotator Kits

GS12500 Polarizer Mount rotatable 3" x 2" slide
GS12501 KRS-5 Benchmark™ Infrared Polarizer kit
GS12502 Ge Benchmark™ Infrared Polarizer kit
GS12502 CaF2 Benchmark™ Infrared Polarizer kit
GS12502 BaF2 Benchmark™ Infrared Polarizer kit
GS12502 ZnSe Benchmark™ Infrared Polarizer kit

Standard Infrared Polarizers

GS12511 KRS-5 Polarizer with rotatable mount
GS12512 Ge Polarizer with rotatable mount
GS12513 CaF2 Polarizer with rotatable mount
GS12514 BaF2 Polarizer with rotatable mount
GS12515 ZnSe Polarizer with rotatable mount

High Extinction Ratio (HER) Polarizers

GS12516 KRS-5 HER Polarizer & rotatable mount
GS12517 Ge HER Polarizer & rotatable mount
GS12518 CaF2 HER Polarizer & rotatable mount
GS12519 BaF2 HER Polarizer & rotatable mount
GS12520 ZnSe HER Polarizer & rotatable mount

Image Quality (IQ) Polarizers

GS12521 Ge IQ Polarizer with rotatable mount
GS12522 ZnSe IQ (3-5µm) Polarizer & rotatable mount
GS12523 ZnSe IQ (8-12µm) Polarizer & rotatable mount

Sample Preparation

A comprehensive range for easy sample prep.

Specac pellet press products facilitate a broad range of laboratory applications.

Products include manual, power, and automatic laboratory hydraulic presses, KBr and XRF pellet presses, sample mills and grinders, evacuable hydraulic pellet press dies, heated platens and film making kits, and sample preparation supplies and consumables.

Presses Introduction

A concise and easy to understand guide on which Specac Press to choose.

Specac makes a variety of hydraulic presses for a wide range of pressing applications. There is also a range of accessories that can be used within the presses themselves, for the formation and preparation of particular sample types prior to analysis by techniques such as Infrared or XRay spectroscopy. The Specac accessories that can be used within the presses are evacuable pellet dies, heated platens and film maker systems.

The Specac presses themselves can be categorised as manual or automatic operated press systems. For manual operation this involves building up the pressure on the system and hence the load that can be applied by hand pumping the press, whereas an automatic press is the build up of pressure on the system and application of a load via pushing of a button.

There are different versions of automatic presses and they can be further categorised as to their mode of operation and functionality.

Each press can be specifically chosen to fulfil a particular application dependent principally on the load range that can be applied. The load is applied according to the operation and the way that the load is applied is due to the functionality of the press.

Further to the functionality in respect of the Atlas® Auto or Power presses, incorporated into the pressing mechanism are compression disc springs that allow for a slow release of any load to the sample pressing procedure.

In the compression process the disc springs will be initially compressed before full resistance is met to stop the travel of the piston. When any stored load is released the disc springs will relax to their non-compressed state and hence provide for a slow release of a full load. For some samples, a slow load release helps to keep the sample in a compacted state and to minimise risk of sample pellet damage.

Press Name	Part Number	Type	Pressure System (Fluid)	Operation To Apply Load	Functionality To Apply Load	Load Range In Tons
Atlas® Manual 15T	GS15011	Manual	Oil (Renolin CL37)	Hand Pump	Manual	1 to 15
Atlas® Manual 25T	GS25011	Manual	Oil (Renolin CL37)	Hand Pump	Manual	1 to 25
Atlas® Power 8T	GS25400	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	1 to 8
Atlas® Power 15T	GS25430	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	2 to 15
Atlas® Power 25T	GS25420	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	3 to 25
Atlas® Auto 8T	GS25800	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	1 to 8
Atlas® Auto 15T	GS25810	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	2 to 15
Atlas® Auto 25T	GS25820	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	3 to 25
Atlas® Auto 40T	GS25830	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	4 to 40

Please note: Specac presses are designed to apply a specific load to a sample, but it is actually the accessory itself within the press that determines the specific pressure applied to the sample.

To give an example, if a 13mm evacuable pellet die P/N GS03000 filled with a powder sample is placed within a 15 ton manual hydraulic press P/N GS15011, an applied load of 10 tons (i.e. 22400 lbs) is being spread over an area of 132.73 mm2 (or 0.205"). This equates to a pressure of 109,268 lbs per square inch or 48.78 tons per square inch.

Similarly, when a film maker accessory (P/N's GS15640 or GS15800) is placed in a press, the load is being spread over an area of film of 660.51 mm2, the films being produced having a 29mm diameter. During this method of film preparation from a melted sample, a load of 1 to 2 tons is usually sufficient to apply an appropriate pressure to the sample.

Presses

Page 106
Atlas® Manual Hydraulic Press

Page 107
Low Tonnage Conversion Kit

Page 108
Atlas® Autotouch Press

Page 110
Atlas® Power Press

Page 111
Mini-Pellet Press

Sample presses for a wide range of applications

Specac offers a range of manual, power, and automatic hydraulic presses for a variety of laboratory press applications. Our hydraulic press products include: KBr pellet presses and XRF pellet presses.

All laboratory hydraulic presses are bench-top mounted, and are compatible with a broad selection of Specac hydraulic pellet press dies and heated platens.

Atlas® Manual Hydraulic Press - 15T & 25T

Easy to use, rugged and durable Hydraulic Presses suitable for a wide range of applications.

Atlas® Manual Hydraulic Press 15T & 25T

The Atlas® 15T and 25T Manual Hydraulic Presses have been designed to handle a wide variety of pressing applications. They are specifically suited to the preparation of KBr discs using the Specac Evacuable Pellet Die assembly.

The Atlas® Presses can also be used with Specac Heated Platens for applications such as the preparation of thin polymer films.

ordering information

GS15011 **Atlas® 15T Manual Hydraulic Press**
GS25011 **Atlas® 25T Manual Hydraulic Press**

Spares and consumables

GS15100 Seals and Gaskets Kit for 15 and 25 Ton Presses
GS15101 Hydraulic Oil for 15 and 25 Ton Presses (1 litre)

Options / Associated products

GS15051 Gauge Conversion Kit 0-1 Ton
GS15052 Gauge Conversion Kit 0-2 Ton
GS15055 Gauge Conversion Kit 0-5 Ton

Service Kits for Atlas Manual Hydraulic Presses

GS15110 Oil Bleed Kit Assembly of parts
GS15111 Seating Tool for Pressure Gauge ball bearing
GS15112 Seating Tool for Release Screw ball bearing
GS15113 Seating Tool for Pressure Relief Valve oil constrictor

Key features

- Polycarbonate safety guards
- Adjustable upper bolster
- Adjustable pressure control valve
- Vacuum Ports
- Pressure release valve
- Gauges for low pressure applications (0-1, 0-2, 0-5 Tons optional)

Specifications

Max. height (at handle) 610mm
Max. width 310mm
Max. depth 190mm
Weight 50kg
Lower piston stroke 25.4mm upper bolster screw travel 89mm
Min. distance between pressing faces 38mm
Max. distance between pressing faces 152mm
Lower pressing face diameter 86mm
Upper pressing face diameter 32mm
Max. width of sampling
Area (side-to-side) 134mm
Max. Depth of Sampling
Area (back-to-front) 141mm

Advanced Solid Pack is also available (see Page 15)

Low Tonnage Conversion Kit for Atlas® 15T Manual Hydraulic Press

The standard 0 to 15 ton manual hydraulic press P/N GS15011 can be operated to apply up to a 15 ton maximum load. On the press itself there is a pressure relief valve (located under the load gauge) which can be set to "vent off" any excess pressure in the pumping system such that a maximum load setting can be selected on the press. This maximum load is indicated on the standard 0 to 15 ton load gauge. Hence, if this pressure relief valve is adjusted accordingly, then it is possible to build up a pressure that corresponds to e.g. a maximum of 5 tons load as indicated at the 15 ton load gauge.

Any further pulls on the pump handle of the press results in this excess pressure being vented off at the pressure release valve. In this way it acts as a safety device to prevent overloading to a sample (or die assembly) in the pressing area.

The low tonnage gauge conversion kits, 0 to 1 tons (P/N GS15051), 0 to 2 tons (P/N GS15052) and 0 to 5 tons (P/N GS15055) provide an additional load gauge to be used along with the standard 15 ton load gauge on the press.

The appropriate gauge kit is fitted by the customer to allow both gauges to be connected to the press. The lower tonnage gauge can be isolated from the system but any pressure of oil in the system will always be registered at the 15 ton gauge. The lower tonnage load gauge has finer divisions for reading of an applied load so if it is important to know that you are applying say 4.1 tons as opposed to say possibly 4.5 tons, then the 0 to 5 ton load gauge reading may be required. But, the press itself could only be operated up to a maximum load allowable with the low tonnage gauge switched on line for reading. As a precaution it is recommended to have the pressure release valve set at the low tonnage gauge load maximum to prevent possible damage to the lower tonnage gauge should it accidentally not be isolated from its own valve tap.

Therefore, in essence the 15 ton press will allow you to apply any load up to 15 tons to a sample or an evacuable pellet die in the pressing area.

However, if a finer reading of the load applied up to a maximum of 5 tons is required, then the additional gauge kit P/N GS15055 can be fitted to the press.

The low ton gauges available for the 15 ton manual hydraulic press and their divisions are:-

0 to 1 ton gauge - gauge divisions every 0.05 tons load.

0 to 2 ton gauge - gauge divisions every 0.10 tons load.

0 to 5 ton gauge - gauge divisions every 0.20 tons load.

As the gauges are analogue (needle pointers) it should be possible to read a value between these divisions, hence for a 0 to 1 ton gauge every 0.025 tons and so on.

ordering information

GS15051	Gauge Conversion Kit 0-1 Ton
GS15052	Gauge Conversion Kit 0-2 Ton
GS15055	Gauge Conversion Kit 0-5 Ton

Atlas® Autotouch Press 8T, 15T, 25T & 40T

Atlas® Autotouch Press - 8T, 15T, 25T & 40T

The Atlas® Autotouch Presses 8T, 15T, 25T & 40T are programmable, microprocessor controlled, power assisted hydraulic presses, operating to 8 Tons, 15 Tons, 25 Tons and 40 Tons respectively. They have been designed for a wide variety of pressing applications including XRF and IR sample preparation. All presses are fully compatible with Specac dies and other sample preparation accessories.

The Presses enable the controlled application and release of an applied load, accommodating samples up to 200mm in diameter. The applied load can be maintained indefinitely, or to a specific time via user programmable functionality.

The graphic display shows the press program status and load conditions providing a digital display of load applied, together with an end of cycle alarm/indicator.

The power unit is extremely quiet and operates below 62dB.

Fitted with PETG safety guards as standard the Atlas® Autotouch Presses are fully CE marked to comply with strict European regulations.

The Atlas® Autotouch Presses have a generous working distance of up to 155mm between the pressing faces and are suitable for the preparation of KBr discs for infrared analysis using Specac evacuable pellet dies. They can also be used with the Atlas® Heated Platens for applications including the preparation of the polymer film substrates.

The Atlas® Autotouch Presses are simple to use and program via the use of screen symbols and prompts. Options include user selectable languages and load units. The Presses durability are ideal for applications such as X-ray fluorescence sample preparation using Atlas® Series Lightweight Dies.

Key features

- Programmable microprocessor controlled pressure application and release
- Simple user operation procedures via symbols and prompts
- Maintain load applied from automatic "top up"
- Graphics display with LED backlight control
- End of cycle alarm or indication
- Integral high clarity PETG safety guards
- Fully CE marked
- Fully compatible with Specac sample preparation accessories

Atlas® Autotouch Press 8T, 15T, 25T & 40T

ordering information

8T

GS25800 UK/Europe (230v, 50Hz)
GS25801 USA (110v, 60Hz)
GS25802 Japan (100v, 50/60Hz)
GS25803 China (230v, 50Hz)
GS25804 Korea (220v, 60Hz)

15T

GS25810 UK/Europe (230v, 50Hz)
GS25811 USA (110v, 60Hz)
GS25812 Japan (100v, 50/60Hz)
GS25813 China (230v, 50Hz)
GS25814 Korea (220v, 60Hz)

25T

GS25820 UK/Europe (230v, 50Hz)
GS25821 USA (110v, 60Hz)
GS25822 Japan (100v, 50/60Hz)
GS25823 China (230v, 50Hz)
GS25824 Korea (220v, 60Hz)

40T

GS25830 UK/Europe (230v, 50Hz)
GS25831 USA (110v, 60Hz)
GS25832 Japan (100v, 50/60Hz
GS25833 China (230v, 50Hz)
GS25834 Korea (220v, 60Hz)

Specifications

Max. Piston Load

8T	15T	25T	40T
8 Tons	15 Tons	25 Tons	40 Tons

8T	Digital Display (.2 Ton Steps)	1-8 Tons
15T	Digital Display (.2 Ton Steps)	2-15 Tons
25T	Digital Display (.5 Ton Steps)	3-25 Tons
40T	Digital Display (.5 Ton Steps)	4-40 Tons

Specifications 8T, 15T, 25T & 40T

Top Bolster Diameter	32mm
Top Lead Screw Vertical travel	90mm
Top Lead Screw Vertical travel	80mm (40T)
Ram (Piston) Bolster Diameter	82mm
Ram (Piston) Stroke	24mm
Ram (Piston) Stroke	38mm (40T)
Max/Min Pressing Faces Dist.	155mm - 40mm
Max/Min Pressing Faces Dist.	140mm - 60mm (40T)
Sample Area (Dia. x Hgt)	220mm x 155mm
Sample Area (Dia. x Hgt)	240mm x 155mm (40T)
Base Footprint (W x D)	425mm x 405mm
Base Footprint (W x D)	430mm x 405mm (40T)
Height (without lead screw)	500mm
Height (without lead screw)	550mm (40T)
Height (Lead screw at min. & max. distances between pressing faces)	545mm - 640mm
Height (Lead screw at min. & max. distances between pressing faces) (40T)	580mm -660mm
Oil Type	Tellus 37
Oil Reservoir Capacity	0.8 litres & 1 litre (40T)
Weight	95Kg & 130Kg (40T)
Communication Type	USB
Display Units	Tons, Tonnes, US Tons
Hold Times	0.1 to 99 minutes and infinity
Optimised Release Rates	Fast, Medium, Slow
Stored Programs	6
Maximum Program Segments	10

Service Kits for Atlas Autotouch 8T, 15T and 25T

GS25880 - Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
GS25881 - Changing the Main Piston Assembly kit of parts (and procedure)
GS25882 - Changing the Motor Pump Assembly kit of parts (and procedure)
GS25884 - Changing an Internal fuse kit of parts (and procedure)
GS25885 - Gaining Access to the Compression Spring Rings kit of parts (and procedure)
GS25886 - Changing and Replacement Lead screw Assembly kit of parts (and procedure)

Service Kits for Atlas Autotouch 40T

GS25890 - Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
GS25891 - Changing the Main Piston Assembly kit of parts (and procedure)
GS25892 - Changing the Motor Pump Assembly kit of parts (and procedure)
GS25894 - Changing an Internal fuse kit of parts (and procedure)
GS25895 - Gaining Access to the Compression Spring Rings kit of parts (and procedure)
GS25896 - Changing and Replacement Lead screw Assembly kit of parts (and procedure)

Atlas® Power Press 8T, 15T & 25T

Atlas® Power Press 8T, 15T & 25T

The Atlas® Series Power Presses 8T, 15T & 25T, are power assisted hydraulic presses operating to 8 Tons, 15 Tons & 25 Tons respectively. They have been designed to handle a wide variety of pressing applications, including XRF & IR sample preparation. All Presses are fully compatible with Specac dies and other sample preparation accessories.

The presses enable the controlled application and release of applied load and can accommodate large samples up to 200mm in diameter. The LCD display shows press status and load conditions giving a digital display of load applied.

Specifications	8T	15T	25T
Max. Piston Load	8 Tons	15 Tons	25 Tons
Digital Display (.5 Ton steps)	1-8 Tons		
Digital Display (.5 Ton steps)		2-15 Tons	
Digital Display (1 Ton steps)			3-25 Tons

Specifications for all 8T, 15T & 25T

Top Bolster Diameter	32mm
Top Lead Screw Vertical travel	90mm
Ram (Piston) Bolster Diameter	83mm
Ram (Piston) Stroke	24mm
Max/Min Pressing Faces Dist.	155mm - 40mm
Sample Area (Dia x Ht)	220mm x 155mm
Base Footprint (W x D)	425mm x 405mm
Height (without lead screw)	500mm
Height	545mm - 640mm
Oil Type	Tellus 37
Oil Reservoir Capacity	0.8 litres
Weight	95Kg

Key features

- Microprocessor controlled pressure application and release
- Large working distance between pressing surfaces
- Fully CE Marked
- Low noise operation
- Liquid crystal digital display
- Multi-lingual display option
- Integral high clarity PETG safety Guards
- Fully compatible with Specac sample preparation accessories

Service Kits for Atlas Power Presses

GS25480 - Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
GS25481 - Changing the Main Piston Assembly kit of parts (and procedure)
GS25482 - Changing the Motor Pump Assembly kit of parts (and procedure)
GS25483 - Changing the Dowty Seals in the Manifold Block (and procedure) (Note: OLD motor pump assemblies only)
GS25484 - Changing an Internal fuse kit of parts (and procedure)
GS25485 - Gaining Access to the Compression Spring Rings kit of parts (and procedure)
GS25486 - Changing and Replacement Lead screw Assembly kit of parts (and procedure)

ordering information

8T	15T	25T	
GS25400	**GS25430**	**GS25420**	UK/Europe (230v, 50Hz)
GS25401	**GS25431**	**GS25421**	USA (110v, 60Hz)
GS25402	**GS25432**	**GS25422**	Japan (100v, 50/60Hz)
GS25403	**GS25433**	**GS25423**	China (230v, 50Hz)
GS25404	**GS25434**	**GS25424**	Korea (220v, 60Hz)

Mini-Pellet Press

A cost effective hydraulic press solution for FT-IR pellet preparation.

Mini-Pellet Press

The Specac Mini-Pellet Press is an innovative low cost solution for the pressing of 7mm KBr pellets.

Designed for use on a laboratory bench top, this dedicated KBr pellet press enables the user to create consistently high quality KBr pellets for transmission FT-IR analysis.

Mini Pellet-Press specifications

Maximum load - **2 tons**
Pellet Die diameter - **7mm**
Maximum space between pressing faces - **50mm**
Minimum space between pressing faces - **12mm**
Piston stroke - **0.5mm**
Die assembly - **hardened 440°C stainless steel**
Upper pressing area
(top lead screw diameter) - **17.0mm**
Lower pressing area (piston diameter) - **21.6mm**
Dimension (ex. lead screws)
W x L x H - 110 x 200 x 155mm
Dimension (inc. lead screws)
W x L x H - 110 x 265 x 215mm
Weight - **4.2Kg**

Key features

- Hydraulic operation enables all users to make high quality KBr pellets
- Integrated pressure gauge ensures consistent pellet quality
- Fast and simple process to get from sample to IR results
- Simple operation requires minimal training
- Small and lightweight

ordering information

GS03940	**Mini-Pellet Press** Also available as part of a Basic Solid Pack (P/N GS01150).
GS03950	7mm Pellet Die Assembly
GS03960	3" x 2" Slide Mounts for 7mm pellet ring holder

Mini-Pellet Press Spares and Consumables

GS03951	Pair of Spare Ring Holders
GS03600	Pestle and Mortar
GS03610	KBr Powder (50g)

The annual demand for cement is almost 5bn tons and is growing steadily.

A key building material, cement comprises limestone and clay, usually mined from nearby quarries. On site tests, including XRF analysis, are performed at the quarry to ensure chemical composition of the rock meets requirements.

Raw rock is crushed and heated above 1000°C in a kiln to become clinker. The clinker is subjected to analysis by XRF. In the next stage, the clinker is ground into a fine powder and mixed with sulphate rich gypsum in varying amounts, to produce different grades of cement, then a final XRF test is carried out.

This note shows how XRF analysis can help to ensure your cement product quality is within specification - **Specac Atlas® Presses and Dies** are perfect for quick and easy XRF sample preparation.

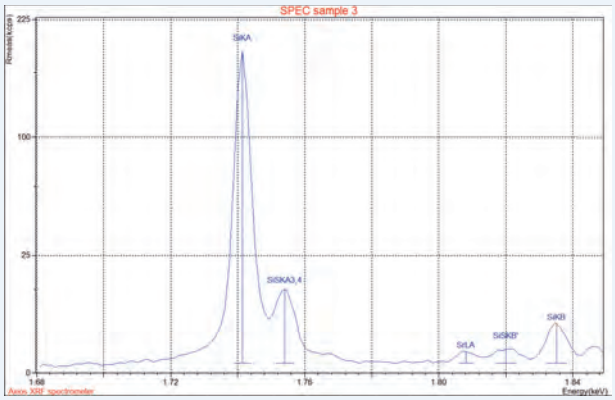


Fig. 1

Analysis

Specimens of Portland cement and a pre-mixed 'Ready-to-use' cement were ground using the P6 ball mill at 300rpm for 10 mins to ensure a fine powder (<60 microns). 6g of the fine powders from each sample were mixed with 1.5g of paraffin binder.

The resulting mixtures were pressed into pellets using the **Atlas® 25 Ton Manual Press** and a **Atlas® 32mm XRF Standard Pellet Die**.

Figures 1 and 2 show the XRF Spectra of the Portland and Ready-to-use cements respectively, focusing on the silicon signal.

There is a higher silicon signal in the Ready-to-use cement (~61%) because it has been premixed with sand, which contains SiO2.

Portland cement has a higher amount of CaO and SO3 than Ready-to-use cement because it contains calcium sulphate and free lime. Monitoring these elemental groups during production is important for quality control of the final cement.

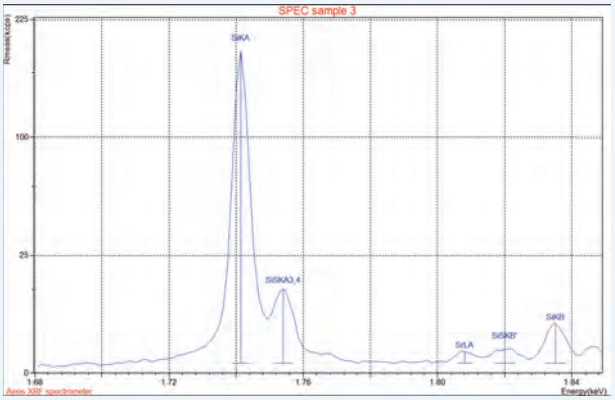


Fig. 2

CONCLUSION

XRF analysis is routinely used in the cement industry at several stages of production:

- **Testing quarry sites to determine mining suitability**
- **Assessing intermediate products like clinker**
- **Quality assessing the final cement to international standards such as ASTM C114**

Different cements are produced to suit a variety of applications. Portland cement is a good standard for construction but changing the chemical makeup of the cement can make products like Ready-to-use cement.

The difference in the composition for these samples was quickly detected by XRF. The Atlas® 25 Ton Manual Press used to prepare the pellet samples for analysis is simple to use and requires little user training.

Dies

Cost effective dies - designed to last

Evacuable pellet press dies are available for Specac manual, power, and automatic hydraulic press products. These pellet press dies are available in a range of diameters from 5 mm to 40 mm as standard, and include the 13 mm KBr pellet press die for FT-IR applications and 32 mm / 40 mm XRF pellet press die.

Atlas® FTIR Evacuable Pellet Dies

Production of high quality sample pellets from 5mm to 40mm diameter.

Atlas® FTIR Evacuable Pellet Dies

Specac manufactures a wide range of high-quality Atlas® FTIR Evacuable Pellet Dies suitable for compacting powdered samples into discs or briquettes. These are particularly well suited for the preparation of solid KBr pellets for FT-IR molecular spectroscopic analysis and XRF pellets for X-Ray Fluorescence atomic spectroscopic analysis (as required by a number of USLP and ASTM methods), but also find use in a broad range of other applications. Atlas Series Evacuable Pellet Dies are typically used in conjunction with the Specac's Atlas Series of Hydraulic Press Products.

These FTIR Evacuable Pellet Dies produce circular pellets in sizes from 5 mm to 40 mm diameter as standard, but other shapes and sizes are available on request. These pellet dies cover a range of load capabilities. For optimum quality and durability of the pellet die, all parts are manufactured from hardened stainless steel, and surfaces that come in contact with the sample are highly polished.

Each Pellet Die comprises of an evacuable base, body, plunger, a pair of internal pellet pressing surfaces, extractor ring, and O Ring Kit.
An evacuation port is provided for removal of moisture, if desired, during the pressing process.

Key features

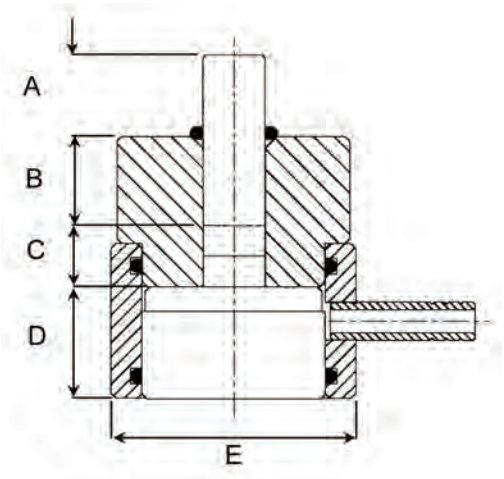
- Hardened Stainless Steel
- Highly polished pellets
- Evacuable for sample pellet clarity and quality
- Vacuum pump kit for moisture free pressing (optional)

ordering information

GS03060	**Atlas® 5mm** evacuable pellet die (Max load 2.0 Tons)
GS03100	**Atlas® 10mm** evacuable pellet die (Max load 5.0 Tons)
GS03000	**Atlas® 13mm** evacuable pellet die (Max load 10.0 Tons)
GS03165	**Atlas® 20mm** evacuable pellet die (Max load 25.0 Tons)

Atlas® FTIR Evacuable Pellet Dies

Die Size	5mm	10mm	13mm	20mm
P/N	GS03060	GS03100	GS03000	GS03165
A	13.7	16	16.0	21.4
B	38.8	19.1	19.1	35.8
C	12.7	12.7	12.7	19.1
D	22.2	22.7	22.2	27.8
E	50.8	50.8	50.8	68.3



A+B = Plunger Height
C = Stainless Steel Pellet Height
D = Base Height
E = Diameter
A+B+C+D = Total Height of Die

ordering information

Atlas® FTIR Evacuable Pellet Dies Options

Size (dia)	Die	Pellet Holder
5mm	**GS03060**	**GS03400**
10mm	**GS03100**	**GS03404**
13mm	**GS03000**	**GS03410**
20mm	**GS03165**	**GS03193***

Spares and consumables

GS03600 Agate Pestle and Mortar (Mortar Bowl dia. 4cm)

GS03610 KBr powder (50g)

GS03460 Paper rings for 13mm die (11mm diameter aperture) (100)

GS03470 Micro frames for 13mm die (11mm x 2mm aperture) (100)

GS03475 Ultra Micro frames for 13mm die (4mm x 1mm aperture) (100)

*These pellet holders are sample retaining rings only and do not have a rectangular mounting plate.

Diameter	Sets of Pellets	Plunger	Body	Base	Extractor Ring	O Ring Kit
5mm	GS03061	GS03063	GS03064	GS03050	GS03069	GS03062
10mm	GS03101	GS03103	GS03104	GS03050	GS03025	GS03102
13mm	GS03010	GS03030	GS03040	GS03050	GS03025	GS03020
20mm	GS03166	GS03168	GS03169	GS03191	GS03521	GS03167

Apex™ Quick Release Die

Apex™ Quick Release Die

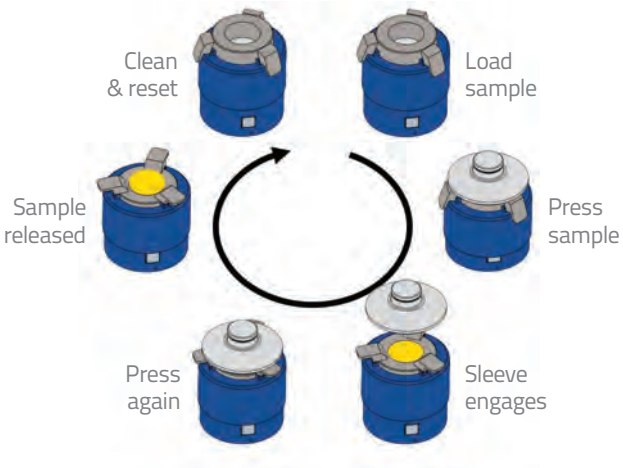
The new Apex™ Quick Release XRF die makes routine pellet preparation simpler and faster than ever before. The unique, patented design completely eliminates the time-consuming pellet extraction step.

Unlike traditional dies, which require the die set to be removed from the press, partly disassembled, and then returned to the press, the Apex™ Quick Release die requires only a light load to eject the pellet from the die. The entire cycle can take as little as 2-3 minutes from loading the sample to retrieving the finished pellet.

Once the pellet is removed, the release mechanism is reset with the press of a button, and the die is ready immediately for the next sample.

Key features

- Patented quick release sleeve design halves the time required to press a sample
- Apply and release the load once to press the sample, once more to eject it from the die body
- Complete automation of the pressing process in conjunction with the Atlas® Autotouch press
- No assembly or disassembly required
- Push-button to reset system for next sample
- Minimal cleaning



General specifications

Die	Max. load	Dimensions	Weight
40mm	40 tonnes	Ø98mm x H112mm	2.7kg
32mm	40 tonnes	Ø98mm x H112mm	2.7kg

Spares and accessories

GS26325 Die body for 40mm APEX™ Quick Release Die
GS26326 Die body for 32mm APEX™ Quick Release Die
GS26321 Plunger for 40mm APEX™ Quick Release Die
GS26322 Plunger for 32mm APEX™ Quick Release Die
GS26310 Top pressing anvil assembly of APEX™ Dies for 40T Autotouch™ Press
GS26311 Top pressing anvil assembly of APEX™ Dies for the 15T/25T Manual and 8T/15T/25T Power/Autotouch™ Presses
GS26315 Top stainless steel polished plate 40mm dia
GS26316 Top stainless steel polished plate 32mm dia
GS26330 Base locator plate for APEX™ Dies
GS26340 Spring for APEX™ Dies (inc. 4 spare locking grub screws)
GS26341 Essential spares kit for Apex Dies

ordering information

Complete dies for Autotouch™ Press

GS26301 40mm Apex™ Quick Release Die with top pressing anvil and base locator plate for 8T, 15T, 25T
GS26302 32mm Apex™ Quick Release Die with top pressing anvil and base locator plate for 8T, 15T, 25T
GS26303 40mm Apex™ Quick Release Die with top pressing anvil and base locator plate for 40T
GS26304 32mm Apex™ Quick Release Die with top pressing anvil and base locator plate for 40T

Atlas™ XRF Standard Pellet Die

Atlas® XRF Standard Pellet Dies

Standard XRF pellet dies for routine preparation of pellet samples. Simple and robust, they are perfect for the pressing of any sample.

Polished internal pellets provide the highest quality analytical pellets. Tungsten carbide pellets are available to avoid Fe contamination.

Key features

- Polished, precision-engineered pellet dies
- Compatible with all Specac presses and many others too
- Evacuable for sample clarity and quality
- (Optional) Tungsten carbide internal pellets to avoid Fe contamination
- (Optional) evacuation port

General specifications

Die	Max. load	Dimensions	Weight
40mm	40 tonnes	Ø65mm x H112mm	2.5kg
32mm	40 tonnes	Ø65mm x H112mm	2.6kg

ordering information

Complete die sets

No evacuation port:

GS26104 40mm Atlas® Standard Die Set
GS26103 32mm Atlas® Standard Die Set

With evacuation port:

GS26102 40mm Atlas® Standard Die Set
GS26101 32mm Atlas® Standard Die Set

Spares and accessories

Die body (no evacuation port):

GS26114 40mm Atlas® Standard Die
GS26113 32mm Atlas® Standard Die

Die body (with evacuation port):

GS26112 40mm Atlas® Standard Die
GS26111 32mm Atlas® Standard Die

GS26122 Plunger for 40mm Standard Die
GS26121 Plunger for 32mm Standard Die

Internal pressing pellets (pair):

GS26132 40mm Stainless Steel
GS26134 40mm Tungsten Carbide
GS26131 32mm Stainless Steel
GS26133 32mm Tungsten Carbide
GS26141 Die base for 32mm & 40mm
GS26152 O-ring kit for 40mm Standard die
GS26151 O-ring kit for 32mm Standard die
GS26161 Extractor cap for 32mm and 40mm

Pelletizing Accessory

P6 Planetary Mill

The P6 Planetary Ball Mill is a high-performance benchtop grinding mill for XRF applications. Fitted with up to two grinding bowls, sample quantities up to 450ml may be quickly and efficiently reduced to tens of microns in size. Its user-friendly design makes the P6 is easy to operate both in the field and in the lab.

Key features

- High speed planetary ball mill (up to 650 rpm)
- Produces fine powders 40-200µm in size
- Grinding balls and bowls in a range of materials and capacities.
- Maximum useful sample capacity of 450ml
- User friendly Safe-Lock-System to prevent accidents
- Benchtop design makes it portable for in field and lab work
- Easily grind hard, medium-hard, brittle and moist materials

ordering information

Selection of grinding bowls and grinding balls

First select the material you want to work with, then select the number of balls per bowl you will need.

Material (bowl+balls)	Main component	Density	Abrasion resistance	Sample type
Agate	(99.9% SiO2)	2.65	Good	Soft to medium-hard samples
Zirconium oxide	(96.2% ZrO2)	5.7	Very good	Fibrous, abrasive samples
Tungsten carbide	(93% WC+6% Co)	14.9	Very good	Hard, abrasive samples
Silicon nitride	(90% Si3N4)	3.25	Extremely good	Abrasive samples, metal-free grinding
Hardened steel	Bowl: (11-12% Cr) Balls: (1.0-1.65% Cr)	7.9	Good	Hard, brittle samples

Number of balls per grinding bowl

Ball diameter	Bowl volume (ml)	80	250	500
5	Number of balls	250 - 300	1200 - 1300	2000 - 2500
10	Number of balls	25 - 30	50 - 150	100 - 250
15	Number of balls	10	45 - 50	70 - 100
20	Number of balls	5	15 - 20	25 - 35
30	Number of balls	-	5-6	10
40	Number of balls	-	-	4

Pelletizing Consumables

Sample Support Cups

Key features

- Compressible support cups that wrap under and around the sample under load
- Provide support to poorly binding samples that cannot form free-standing pellets
- Available in aluminium or plastic
- Lubricious plastic aids in pellet release
- Suitable for 32mm and 40mm die sets

Part number	Description
CX0505E	PelletCups™ Compressible Tapered Aluminum Briquetting Cup, 31.0mm Dia. x 8.0mm Tall 1000/pk
CX0513E	PelletCups™ Compressible Tapered Aluminum Briquetting Cup, 12.5mm Dia. x 8.7mm Tall 250/pk
CX0535E	PelletCups™ Compressible Tapered Aluminum Briquetting Cup, 34.6mm Dia. x 9.3mm Tall 600/pk
CX0545E	PelletCups™ Compressible Tapered Aluminum Briquetting Cup, 39.8mm Dia.x 9.6mm Tall 600/pk
CX0547E	PelletCups™ Compressible Tapered Aluminum Briquetting Cup, 44.9mm Dia. x 9.6mm Tall 600/pk
CX0552E	PlastiCup™ Compressible Tapered Plastic Briquetting Cup, 31.0mm Dia. x 6.4mm Tall 500/pk
CX0553E	PlastiCup™ Compressible Tapered Plastic Briquetting Cup, 34.3mm Dia. x 6.4mm Tall 500/pk
CX0554E	PlastiCup™ Compressible Tapered Plastic Briquetting Cup, 39.7mm Dia. x 6.4mm Tall 500/pk

Protective Pellet Films

Key features

- Protect pressing surfaces from cross-sample contamination
- Applied to the surface in direct contact with the sample
- 32, 35, and 40mm diameters

Part number	Description
CX7032E	SpectroPellet™ Protective Die Pellet Film for 32mm dies; 500 per pkg
CX7035E	SpectroPellet™ Protective Die Pellet Film for 35mm dies; 500 per pkg
CX7040E	SpectroPellet™ Protective Die Pellet Film for 40mm dies; 500 per pkg

Specac brilliant spectroscopy

Specadie™

Produces KBr pellets without using a press.

Specadie™

The Specadie™ accessory allows for the production of a solid KBr pellet for analysis by infrared spectroscopy without the need of a separate press and die.

The Specadie™ consists of a die body and two bolts that each have a highly polished pressing face. In operation a ground KBr powder is placed in the die body and compressed between the two bolts that are tightened together. A KBr pellet of 8.5mm diameter is formed. The bolts are then removed and the compressed KBr powder is retained inside the die body. The die body in turn acts as the pellet holder and is placed into a spectrometer via the Specadie™ holder 3" x 2" mount plate P/N GS03560

Key features

- No press or pellet holder required
- Rapid sample preparation
- Evacuable for sample clarity and quality

ordering information

GS03550 **Specacdie™** only, with bolts and seals

Specadie™ Kit

GS03700 Includes: Specadie™
Specadie™ Holder
Bench mounted wrench (spanner)
Open ended wrench (spanner)
Spare set of bolts
Spare set of seals
Bottle of KBr powder (50g)

Spares and consumables

GS03560 Circular Specadie™ Holder
GS03570 Set of bolts
GS03590 Set of two open ended wrenches (spanners), 9/16" (14.3mm) and 1/2" (12.7mm) AF
GS03595 Bench mounted wrench (spanner)
GS03580 Set of seals
GS03610 KBr powder (50g)

Film-Makers

Page 122
Atlas® Heated Platens

Page 123
Atlas® Film-Makers

Page 125
Mini Film-Maker kit

Page 127
Specacards & Film Holders

For high quality, reproducible polymer films

Heated platen and thin film making accessories for Specac hydraulic presses.

These are designed for the fabrication of thin films of polymer materials for FT-IR transmission spectroscopy. Standard and high-temperature thin film-making kits are available.

Atlas® Heated Platens

A quick and simple accessory for converting standard Hydraulic Presses to heatable versions.

Key features

Digital temperature display
Controlled temperature to 300°C with water cooling
15 Ton load bearing capacity
CE Safety Approved
100mm diameter pressing surface
Compatible with all Specac Hydraulic Presses

Atlas® Heated Platens

The Atlas® Heated Platens have been designed to provide heatable pressing surfaces compatible with all Specac Hydraulic Presses. The platens are easily installed by replacing the bolster fixing of the press by the top platen and placing the bottom platen over the lower pressing face of the press.

The platens have a large surface area, are rugged, durable and have full CE safety approval. They are fitted with a permanent thermocouple which monitors the temperature close to the pressing surface. The press connection ports are water cooled which allows for an efficient heating and cooling cycle.

The platens are controlled by a digital automatic temperature controller with a stability of ± 1°C

ordering information

GS15515 **Atlas® Water Cooled Heated Platens** and Automatic Temperature Controller with Digital Display.
Includes 2 metres of 6mm id. PVC tubing and flow connectors.

Specify 220V or 110V and country of usage

Spares and consumables

GS15601 **PTFE sheets** 0.25mm thick for Water Cooled Heated Platens (10)

GS15512 **Replacement heater** set for Platens (220V)

GS15522 **Replacement heater** set for Platens (110V)

Atlas® Constant Thickness and High Temp. Film-Maker

Film making systems to produce high quality, reproducible polymer films.

P/N GS15800

P/N GS15640

Key features - GS15800

Up to 400°C operation
40 minute cycle time
CE Safety Approved
Integral heating and cooling
2 Ton load limit
0.015, 0.025, 0.050, 0.100, 0.250, 0.500mm films of 29mm diameter
Easy film release

Key features - GS15640

Up to 300°C operation
30 minute cycle time
4 Ton load limit
0.015, 0.025, 0.050, 0.100, 0.250, 0.500mm films of 29mm diameter
Easy film release
Operates with Heated Platens P/N GS15515

Atlas® Constant Thickness Film-Maker

Specac make two types of film-maker accessory that are ideal for the preparation of thin films from polymers materials. The films produced are 29mm in diameter and can vary in thickness due to use of a set spacing ring. Individual spacing rings are supplied for a nominal thickness of film at 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 millimeters. The principal difference between the two film-maker accessories is the maximum operating temperature allowable by each one.

The Constant Thickness Film-maker Accessory P/N GS15640 is designed to be used with the Atlas Heated Platens P/N GS15515 within a 15 Ton Manual Hydraulic Press P/N GS15011. However, the 25 Ton Manual Hydraulic Press P/N GS25011, the Atlas Power 8T Press P/N GS25400 and Atlas Auto 8T Press P/N GS25440 can also be used with the Atlas Heated Platens P/N 15515 and Film-maker Accessory P/N GS15640.

The Atlas® Heated Platens provide the temperatures necessary to melt a sample within the film maker accessory prior to compression via the press. The maximum temperature provided by the Atlas Heated Platens is 300°C, so any materials that have a melting point higher than this are not suitable for forming into thin films using the Atlas® Constant Thickness Film-maker P/N GS15640. The specified maximum load limit for this accessory within the press is 4 tons when indicated at the load gauge on the Manual Hydraulic Presses and digital display on the Atlas Power and Auto Presses. Typically a 1 ton load gives acceptable results for film thickness.

Atlas® High Temperature Film-Maker

The High Temperature Film-maker Accessory P/N GS15800 has a set of heated platens already incorporated into the film making part of the accessory and so the Atlas Heated Platens P/N GS15515 are not needed for use when P/N GS15800 is installed in a press. (The High Temperature Film- maker Accessory P/N GS15800 will fit into the same presses for use as the combination of P/N's GS15515 and GS15640.)

The heated surfaces of P/N GS15800 are operable up to 400°C, so it is possible to make thin films of samples with melting points up to this temperature in this film maker accessory. The maximum load limit for this accessory is 2 tons when indicated at the load gauge on the Manual Hydraulic Presses and digital display on the Atlas Power and Auto Presses, but similar to the constant thickness film maker, acceptable maker, acceptable results for film thickness is typically achieved at a 1 ton load.

Specac brilliant spectroscopy

Atlas® Constant Thickness and High Temp. Film-Maker

ordering information

GS15640 **Atlas® Constant Thickness Film-maker**
Includes: 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 mm spacer rings
Aluminium foil discs 40mm dia. (200 off)
Specacards 10mm diameter clear aperture (20)
Stainless steel forceps

GS15800 **Atlas® High Temperature Constant Thickness Film-maker**
Includes: 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 mm spacer rings
Aluminium disc foils 40mm dia. (200 off)
Tool for making aluminium foil sample cup
Specacards 10mm dia. clear aperture (20)
Stainless steel forceps
High stability digital temperature controller (400°C)
Non-drip water connectors

Film-maker Kits

GS15631 **Atlas® Constant Thickness Film-maker Kit 1**
Includes: Constant Thickness Film-maker System (GS15640) Heated Platens and Digital Automatic Temperature Controller (300°C) (GS15515)

GS15633 **Atlas® Constant Thickness Film-maker Kit 2**
Includes: Constant Thickness Film-maker System (GS15640) Heated Platens and Digital Controller (300°C) (GS15515)
15 Ton Manual Hydraulic Press (GS15011)

(Specify 220V or 110V and country of usage for GS15800, GS15631 and GS15633)

GS15810 **Atlas® High Temperature Constant Thickness Film-maker Kit**
Includes: High Temperature Constant Thickness Film Maker System (GS15800)
15 Ton Manual Hydraulic Press (GS15011)

(Specify 220V or 110V and country of usage)

Spares and Consumables

GS03800 10mm diameter aperture Specacards (100)
GS03805 Nylon retaining rings for supporting elastic film samples (20)
GS03810 10mm x 25mm aperture Specacards (100)
GS03820 Magnetic film holder
GS15627 40mm diameter aluminium foil discs (200)
GS15641 Constant Thickness Film Maker Replacement Cooling Block Assy
GS15642 Constant Thickness Film Maker Replacement Platen Assy
GS15629 Constant Thickness Film Maker Replacement Spacer Ring Set
GS15805 High Temperature Film Maker Replacement Spacer Ring Set

Mini Film-Maker Kit

A dedicated polymer thin film-making accessory for IR transmission analysis.

Mini Film-Maker Kit

The Specac Mini Film-maker Kit is designed to produce high-quality thin films of polymer and plastic materials for infrared transmission analysis.

This product enables quick and easy hot pressing of pellets and other sample forms from ambient to 250°C, to give constant and reproducible thickness films over the range 15 to 500 microns with a formed diameter of 15 mm.

The accessory consists of an integrated hydraulic press, digital temperature controller, and heated platens, together with a lightweight film maker assembly.

This design allows the heated platens to be pre-heated and held at the melt-point temperature required for the sample. The film-maker assembly is separately prepared with a few tens of milligrams of the sample material and appropriate sizing ring, before being introduced to the pre-heated platens.

After the film maker assembly has stabilised to the preset temperature, a load of typically 0.5 Tons is applied by rotating the press lead screw to hot press the film. On removal from the heated press, the low-thermal mass film maker assembly quickly returns to ambient temperature on the cooling plate and the pressed film is removed.

The film can then be mounted in a 3 by 2 inch self adhesive card (Specacard) for infrared transmission analysis. This process appreciably shortens the film making process cycle time compared with conventional methods and, in practice, a cycle time of less than 5 minutes is possible for producing a thin film.

Key features

Quick and reproducible thin film production
Sample melt points from ambient to 250°C
Standard film sizing rings of 15, 25, 50, 100, 250 and 500 microns producing 15mm dia. films
Dedicated film maker accessory with hydraulic press and integrated heated platens
Cycle time 5 mins

The Specac Mini Film-maker Kit includes the Mini Film-maker Press with integrated heated platens and digital temperature controller, a Film-maker Assembly with Film Sizing Rings of 15, 25, 50, 100, 250, and 500 microns, 200 pairs of Aluminium Foil Discs, a Cooling Plate, 100 Specacards, and Stainless Steel Tweezers (Forceps).

A set of US, EU, and UK power leads is provided as standard.

Typical uses of this accessory include producing thin films for infrared quantitative analysis of polymers and plastics for regulatory or production quality assurance purposed, as well as method development for process analysis. Other applications include thin film making for tensile strength studies.

Mini Film-Maker Kit

Mini Film-Maker Specifications

Maximum load - **2 Tons**
Temperature range Ambient to - **250°C**
Temperature control - **1°C steps**
Thin film formed diameter - **15 mm**
Thin film thickness **15, 25, 50, 100, 250 & 500 microns** (nominal)
Press dimensions **104mm ×198mm ×197mm** (W ×H ×L) (excluding lead screw)
Weight of press and controller - **5.7Kg**
Supply voltage - **110/220V**
Output voltage - **30V DC**
Heater power - **35W**

ordering information

Mini Film-Maker Kit

GS03970 **Mini Film-Maker Kit**

Spares and consumables

GS03971 Mini-Film maker Assembly (includes to platen assembly, shield, lower platen assembly, and set of sizing rings)

GS03972 Sizing rings set (15, 25, 50, 100, 250 & 500 microns)

GS03973 Set of aluminium foil discs (200 pairs)

GS03974 Cooling Plate for Mini Film-maker

GS03975 Mini Film-maker Platen Set (includes top platen assembly, shield, and lower platen assembly)

GS03800 Specacards (pkt 100) 10mm dia. aperture

GS15628 Stainless steel tweezers (forceps)

How to produce a thin film

Place the shield, selected sizing ring and smaller foil on the lower assembly.

1) The sample is put into the middle of the foil before the larger foil and upper assembly are added on top.

1)

2) The whole assembly is placed between the pre-heated platen surfaces so that a tonnage load can be applied.

2)

3) Once the sample has been compressed and removed from the press, take apart the assembly and carefully peel the foils away from the film inside.

3)

4)

4) The film can then be put in a Specacard and placed into the spectrometer for analysis.

Specacards & Magnetic Film Holder

P/N GS03800

P/N GS03810

P/N GS03820

Key features

Self sealing adhesive coating (Specacard)
Magnetic ring (Film Holder)
Indexing space (Specacard)
Clear aperture:
10mm diameter or 25 x 10mm (Specacard)
25mm diameter (Magnetic Film Holder)
3" x 2" Slide mounted

ordering information

Specacards & Magnetic Film Holders

GS03800 Specacards 10mm diameter aperture (100 off)

GS03810 Specacards 25 x 10mm aperture (100 off)

GS03820 Magnetic Film Holder

Botanical sample analysis

SPECAC APPLICATION NOTE

The different chemical makeup of leaves, petals and even pollen may be detected using infrared spectroscopy.

Traditionally, wet bio-samples like leaves had to be dried and ground with KBr to make pellets. These would then be pressed and placed in a spectrometer.

This is a very slow and outdated method of analysis and requires a lot of sample preparation.

Conversely, attenuated total reflectance (ATR) requires no sample preparation and is a fast way of analyzing multiple samples. Moreover, modern ATR accessories like the Quest™ can handle wet samples like plants easily.

This application note describes the simple analysis of Winter Rose buds of different ages.

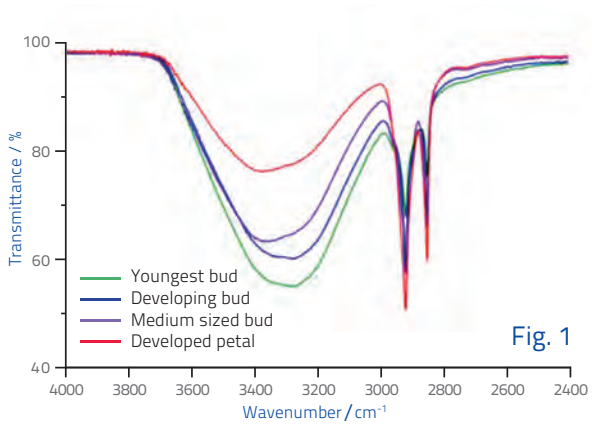


Fig. 1

Experiment

Plants draw upon various nutrients to produce organic molecules, which give rise to complex absorption features in the infrared spectrum.

In addition, plant matter shows strong water absorbances. The relative quantities of these substances can be seen to change as the bud develops into a flower.

Fig. 1 shows 4 example ATR spectra of Rosa Meillandina buds. All of them show a broad feature at 3300 cm^{-1}.

This is the strong water absorption band and is a common feature in IR spectra of wet samples. As the bud gets older, it appears to contain less water.

Also present in Fig. 1 are two sharp features at 2914 and 2846 cm^{-1}, which are characteristic of CH_2 stretches of long chain aliphatic compounds.

These bands seem to increase in intensity as the bud matures.

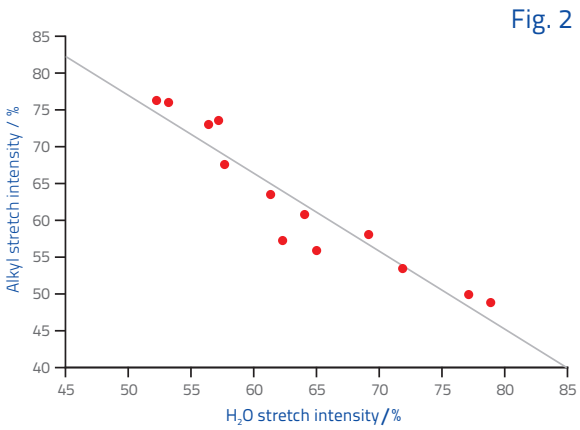


Fig. 2

The change in intensity of the sharp peak at 2914 cm^{-1} and the broad water peak are plotted in Fig. 2. Clearly, there is a relationship between the water and hydrocarbon sugars.

CONCLUSION

The analysis showed that as the rose buds aged, there was less water and more sugar in the petals. This is likely to be a result of greater photosynthesis in mature roses.

Recording IR spectra of several plant samples was done easily and quickly using the Quest™ ATR. Similar analysis on wet bio-mass samples is also possible. More in depth analysis can be made to check the effect of environmental conditions on plants.

Sample Preparation Supporting Accessories

Sample preparation supporting accessories

Various additional products are available from Specac with associated uses for hydraulic press and pellet press laboratory applications. These include vacuum pump kits, sample drying cabinets, mill and grinding accessories.

Specamill™

Provides efficient grinding and blending of solid materials.

Specamill™

The Specamill™ grinding accessory is designed to mix a solid sample with an excess of KBr powder for the preparation of powder samples prior to compression into KBr pellets for IR study. It can also be used in preparing samples for diffuse reflectance spectroscopy. The target particle size of the sample is at least 0.025mm (if not smaller) to coincide with the wavelength of light in the classical Mid IR region. Final particle size will depend specifically on the actual sample and the mixture proportions and the amount of time being applied for the grinding process.

There are two capsule sets that can be used within the Specamill™ grinding accessory P/N GS06000. One capsule set P/N GS06200 is an agate capsule set and the other P/N 6100 is a stainless steel capsule set. Each set consists of a capsule body, stopper and three grinding balls fabricated in the agate or stainless steel.

The reason for use of either set is principally due to the difference in hardness of material. Agate, being a naturally occurring mineral is typically between 6 and 7 on the Mohs scale of hardness. Steel, depending on its fabrication and chemical make up, can vary from between 5 to 8.5 on the same Mohs scale of hardness. The Specac stainless steel capsule set is typically of a Mohs hardness of 7.5.

The capacity of each capsule is 3ml and the recommended filling volume is 30% (excl. spheres).

Key features

Rapid grinding
Choice of capsule and sphere materials
Adjustable vibration
Timer with manual override

Key features

Grinding and blending a wide variety of materials
Sample preparation for KBr pellets
Sample preparation for diffuse reflectance spectroscopy

ordering information

GS06000 **Specamill™ (220V, 50Hz) UK**
GS06001 **Specamill™ (220V, 50Hz) EU**
GS06800 **Specamill™ (110V, 60Hz) US**

The Specamill requires a capsule set

Capsule sets

GS06100 Stainless steel capsule for Specamill™
Includes Stainless steel stopper Stainless steel spheres (3)

GS06200 Agate capsule for Specamill™
Includes Agate stopper
Agate spheres (3)

Spares and consumables

GS06300 Agate spheres for Specamill™ (3)
GS06400 Stainless steel spheres for Specamill™ (3)
GS06500 Replacement Blade for Specamill™
GS06600 Replacement Clip for Specamill™
GS06700 Spare Capsule Holder for Specamill™

Specacabinet™

Allows storage of hygroscopic infrared materials under controlled conditions.

Specacabinet™

The Specacabinet™ is a drying cabinet suitable for the storage of hygroscopic materials (such as IR cell windows or reference samples) and any other accessories that require a moisture free storage environment.

The Specacabinet™ is thermostatically controlled over the temperature range from ambient to 80°C.

A drying agent is included with a colour indicator allowing for a constant check on the humidity.

Specifications

Thermostatically controlled up to 80°C (stability ±0.5°C)
Sliding doors
Size (L x W x H): Internal: 737 x 331 x 432mm
External: 762 x 356 x 508mm
Can be wall mounted

ordering information

GS19100 Specacabinet™ (220V, 50Hz) UK
GS19102 Specacabinet™ (220V, 50Hz) EU

Thermostatic Bath

Thermostatic baths for temperature control.

Thermostatic Bath

These thermostatic baths are designed to supply accurately temperature controlled fluid to any thermo-circulated accessory that requires temperature control. They can also be used from ambient temperature up to 120°C. They can also be used with certain accessories that require a source of cooling water but are not able to be sited near to a water source. In this case the heating system is not used and the integral pump simply circulates the water back to the bath. Note that the bath water will need to be replaced with cold water at intervals dependant on the amount of heating being removed from the accessory. The 12 litre tank is recommended for this application.

The baths consist of a digital immersion thermostat with a choice of two tank sizes (5 or 12l). The immersion thermostat includes a powerful pump, timer function and a variable high temperature alarm setting. The temperature range and heater power are automatically limited according to the liquid type selected.

Specifications

Temperature range: 0°C to 120°C
Stability, stainless steel tanks @ 37°C +/- 0.02°C
Uniformity, stainless steel tanks @ 37°C +/- 0.05°C
Setting resolution: 0.1°C
Display: 4 digit 13 mm LED
Display resolution: 0.1°C
Timer function: 1 to 9999 mins
No. stored temperature values: 4

ordering information

GS11127 **5 Litre Thermo Circulator with lid**
GS11128 **12 Litre Thermo Circulator with lid**

Vacuum Pump System

Vacuum pump system for evacuable dies.

Vacuum Pump System

The vacuum pump P/N GS03640 is a two stage vacuum pump capable of pulling a vacuum to 0.05 Torr or better. It is an ideal vacuum pump to use with the Specac Accessories that have the capability of being operated under these vacuum conditions.

It is designed for normal starting in low temperature and low voltage conditions. (Typically temperatures at or above 5°C with a +/- 10% rated voltage).

An air passage prevents any pump oil from returning into the pipeline or vacuum vessel being pumped after the vacuum pump is stopped.

There is an inbuilt oil mist eliminating device and it has an oil/gas separator at the air exhaust outlet which removes any oil contamination in the air exhaust. The pump operates at a high ultimate vacuum with low noise.

Each vacuum pump has been factory tested for its vacuum pump speed in both CFM and micron units.

The vacuum pump GS03640 is supplied along with an appropriate kit of parts (a pressure gauge, vacuum tubing and particular connecting unions) compatible for immediate use with the appropriate Specac accessories.

Specifications

No of stages: 2
Free Air Displacement: 85 litres/min at 220 volts operation
Ultimate vacuum: 15 microns
Pump motor: 0.25 HP
Pump speed: 2880 rpm (220 Volts), 3440 rpm (110 Volts)
Electrical connectivity: 220 Volts/50 Hz, 110 Volts/60 Hz
Oil capacity: 400mls
Maximum operating temperature capability: 80°C
Minimum operating temperature capability: 1°C
Overall width (side to side dimension): 150mm
Overall length (front to back dimension): 350mm
Overall height (to top of handle): 250mm

ordering information

GS03640 **Vacuum Pump System**
For producing clear, moisture free sample pellets with the Evacuable Pellet Dies.
Includes: Vacuum Pump (1 x 10^{-1} mbar), gauge & connector tube.

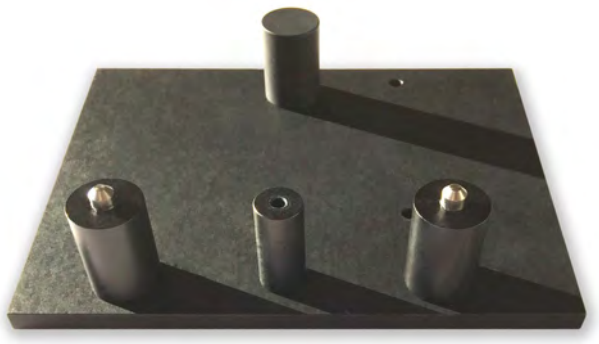
(Please state 220V or 110V and country)

Spares and consumables

GS03643 Vacuum Pump Oil (1 litre)

Benchmark™ Baseplate

A Benchmark™ Baseplate is required to install most Specac accessories into the spectrometer sample compartment.



Most Specac accessories are installed into a spectrometer sample compartment via an adapter baseplate.

The most commonly used type is known as a Benchmark™ Baseplate. The accessory locates onto the top of the Benchmark™ Baseplate and is held secure by a single thumbscrew fixing, usually into a location pillar at the front of the baseplate. There are three further support and location pillars arranged in a triangular configuration on the plate to match the height of the thumbscrew location pillar, such that the accessory is placed level to be presented at the correct beam height and spatial position in the spectrometer sample compartment. It is this arrangement of pillars (or location holes and pins for low beam height spectrometer systems) on a support plate that denotes a Benchmark™ Baseplate configuration.

The metal plate that carries the pillars or location holes and pins is a particular shape and unique to a specific spectrometer sample compartment. It is this metal plate that is directly attached to the floor of a spectrometer. The Benchmark™ Baseplate may be suitable for a number of spectrometer models from the same manufacturer, and when placed into the spectrometer, will allow any Benchmark™ Baseplate compatible accessory to be correctly mounted for operation.

The accessories can be changed over for operation simply by undoing the thumbscrew connection on the accessory itself. The Benchmark™ Baseplate part does not need to be removed from the spectrometer sample compartment. An advantage is that once an accessory has been finely aligned for operation in a particular spectrometer on the Benchmark™ Baseplate, as long as the optical settings on the accessory are not altered, it can be removed from the spectrometer as many times as required and is ready for use the next time it is installed.

ordering information

Compatibility

Quest™ ATRs (GS10800)
Golden Gate® ATRs (GS10500)
Gateway™ ATRs (GS11165)
Pearl™ Liquid Analyser (GS31000)
Cyclone™ Gas Cells (GS24102, GS24105, GS24110, GS24120)
Tornado™ Gas Cells (GS24205, GS24210, GS24220)
Minidiff Plus (GS04510)
Microfocus Beam Condenser (GS02560, GS02561)
Variable Temperature Cell Holders (GS21525, GS21530)
Fixed Angle Specular Reflectance Accessory (GS19820)

Benchmark™ Baseplate compatible: look for this symbol.

Consumables

Page 136
Liquid and Solid Sampling Cups

Page 139
Thin-Film Support Windows

Page 141
Grinding, Pelletizing & Fusion Consumables

For liquid and solid sampling

Specac offer a range of consumables for sampling of liquids and loose, uncompressed powders including sample cups and thin-film sample support windows.

A range of grinding and pelletizing additives may be purchased to aid pressing of certain samples.

Borate fluxes for use with fusion ovens in preparation of fused sample beads are also available.

Specac brilliant spectroscopy

XRF Sample Cup Guide

Sample cups are disposable plastic containers used for sampling of liquids and powders, sealed with a thin film window that is transparent to the measuring X-Rays. There is a large variety of sample cups and film windows on offer, and the following serves as a rough guide to choosing the correct type.

Choosing the right size

Different spectrometers require different cup sizes. Consult the documentation for your spectrometer to determine the correct diameter and height of sample cup to fit the holder on the spectrometer.

Single or double open-ended?

A double open-ended cup is prepared by placing a film window over one end and then filling the cup from the opposite end so that the sample is supported directly by the film window. If the film window is very thin, or is prone to chemical attack by the sample, then it may not be desirable for the window to support the sample in this way for long periods. In these instances a single open-ended cup may be used that allows the sample to be supported by the cup itself during filling and storage, and only be supported by the window once inverted for measurement.

Supporting thin film materials

The supporting window must be transparent to all the signals produced by the analytes of interest, as well as chemically compatible with the sample. There is currently a large range of window materials available in various thicknesses to contain the sample, such as polypropylene, Kapton and Mylar™. Thicker films will be more durable, but will also attenuate the X-Ray signals more strongly.

Chemical	Mylar™	Poly-	ETNOM™	Polypro-	Kapton™	Prolene™	Ultra	Zythene™
Acid, dilut.	✓	✓	✓	✓	✗	✓	✓	✓
Acids, conc.	✓	✓	✓	✓	✗	✓	✓	✓
Alcohols	✗	✓	✓	✓	✓	✓	✗	✓
Aldehydes		✓	✓	✓	✓	✓		✓
Alkalies, conc.	✗	✗	✓	✓	✓	✓	✗	✓
Esters	✗	✗	✓	✓	✓	✓	✗	✓
Ethers	✓	✗	✓	✗		✗	✓	✓
Aliphatic Hydro-	✓	✗	✓	✓	✓	✓	✓	✓
Aromatic Hydro-	✗	✗	✓	✗	✓	✗	✗	✓
Halogenated	✓	✗	✓	✗	✓	✗	✓	✓
Ketones	✗	✗	✓	✓	✓	✓	✗	✓
Oxidizing Agents	✓	✗	✓	✓	✗	✓	✓	✓

Note: ASTM methods for analysing sulfur in diesel stipulate the use of Kapton or Etnom windows only.

XRF Sample Cup Guide

Single and double open-ended sampling cups in a variety of sizes to suit a majority of commercially available XRF spectrometer systems.

1000: TrimLess™ Sleeved Single and Double Open-Ends
- Completely envelops thin-film
- Eliminates thin-film trimming
- ThermoPlastic™ seal venting

1300: TrimLess™ Sleeved Re-Sealable Double Open Ended
- Re-sealable cap with integrated vent
- External overflow reservoir integrated in cap
- "Snap-On Ring" with bead-to-indent geometry

1400: Micro-sample Single Open-Ended
- Internal standard mounting option
- Dual ThermoPlastic™ seal venting
- "Snap-On Ring" thin-film attachment

1500: Microporous Double Open-Ended
- Top sample filling
- Film attachment provision
- "Snap-On Ring" thin-film attachment

1700: "Snap-Post" Venting Single Open-Ended
- External overflow reservoir
- "Snap-On Ring" thin-film attachment

1800: ThermoPlastic™ seal venting Single Open-Ended
- External overflow reservoir
- "Snap-On Ring" thin-film attachment

1900: "Snap-On Ring" Double Open-Ended
- Top sample loading
- "Snap-On Ring" thin-film attachment

2100: SpectroCup™ Double Open-Ended
- TrimLess™ sleeve envelops thin-film
- Top sample loading
- Internal overflow reservoir
- Vented friction fitting cap

Sample Cups

ordering information

TrimLess™ Sleeved Sample Cups

Part number	Series	Diameter	Height	Volume	Spectrometer code
CX1060E	1000	31.2mm	23.6mm	22	S1, S2, X1, X2
CX1065E	1000	31.2mm	23.6mm	8	S1, S2, X1, X2
CX1070E	1000	31.2mm	23.6mm	9	S1, S2, X1, X2
CX1075E	1000	31.2mm	23.6mm	11	S1, S2, X1, X2
CX1083E	1000	31.2mm	23.6mm	9	H1
CX1095E	1000	31.2mm	23.6mm	7	P1, R1, R2, R3
CX1330E	1300	31.2mm	23.6mm	7	S1, S2, X1, X2
CX1330-SE	1300	31.2mm	23.6mm	22	S1, S2, X1, X2
CX1340E	1300	31.2mm	23.6mm	7	S1, S2, X1, X2

Single Open-Ended Sample Cups

Part number	Series	Diameter	Height	Volume	Spectrometer code
CX1430E	1400	31.0mm	22.4mm	8	S1, S2, X1, X2
CX1430-SE	1400	31.0mm	22.4mm	1	S1, S2, X1, X2
CX1440E	1400	39.4mm	22.4mm	8	S1, S2, X1, X2
CX1730E	1700	30.7mm	23.1mm	15	S1, S2, X1, X2
CX1730-SE	1700	30.7mm	23.1mm	19	S1, S2, X1, X2
CX1740E	1700	39.1mm	23.6mm	7	S1, S2, X1, X2
CX1830E	1800	31.0mm	22.1mm	7	S1, S2, X1, X2
CX1830-SE	1800	31.0mm	22.1mm	22	S1, S2, X1, X2
CX1840E	1800	39.1mm	23.6mm	7	S1, S2, X1, X2

Double Open-Ended Sample Cups

Part number	Series	Diameter	Height	Volume	Spectrometer code
CX1530E	1500	31.0mm	23.1mm	22	S1, S2, X1, X2
CX1530-SE	1500	31.0mm	23.1mm	25	S1, S2
CX1930E	1900	31.4mm	21.3mm	0.5	S1, S2, X1, X2
CX1930-SE	1900	31.4mm	21.3mm	13	S1, S2, X1, X2
CX1935-OXE	1900	31.2mm	38.4mm	13	S1, S2, X1, X2, O1
CX1940LE	1900	39.4mm	35.3mm	15	O1

Double Open-Ended SpectroCup™ Sample Cups

Part number	Series	Diameter	Height	Volume	Spectrometer code
CX2131E	2100	30.9mm	29.2mm	12	S1, S2, X1, X2
CX2132E	2100	31.5mm	29.2mm	9	S1, S2, X1, X2
CX2135E	2100	34.3mm	29.7mm	9	P1, P2
CX2140E	2100	40.1mm	29.7mm	9	B1, B2, P1, R1, R2, R3
CX2143E	2100	40.1mm	29.7mm	19	B3, B4
CX2144E	2100	40.1mm	33.8mm	19	B3, B4
CX2145E	2100	44.7mm	29.5mm	25	P2, P3
CX2146E	2100	44.7mm	33.5mm	22	T1
CX2147E	2100	44.7mm	29.5mm	11	T2
CX2148E	2100	44.7mm	33.5mm	12	T3
CX2149E	2100	44.7mm	39.2mm	22	P4
CX2195E	2100	43.4mm	40.7mm	12	P1, R1, R2, R3

Spectrometer Codes

Spectro	
Xepos	S1
X-Lab 2000	S2

Xenemetrix	
X-Calibur	X1
X-Cite	X2

Rigaku	
Primus	R1
ZSX-100	R2
Rix	R3

Oxford	
Lab-X	O1

Bruker	
Manual S2	B1
Manual S4	B2
Auto S2	B3
Auto S8	B4

Panalytical	
Venus 200	P1
Axios	P2
Epsilon 3	P3
MiniPal	P4

Thermo	
Advant'x	T1

Horiba	
Sulfur Analyzers	H1

If your spectrometer is not listed above, please contact Specac for advice on how to find the correct sample cup.

Thin Film Windows

Fabricated and stored under environmentally controlled conditions to avoid introducing trace levels of contaminant, they are available in a variety of formats including rolls (continuous and perforated), pre-cut sheets, or supported in a card frame for ease of application.

Thin-Film Sample Support Windows

Key features

- Pre-cut circles available in Kapton™, Microporous, Mylar™, Polypropylene, and Prolene™
- Roll available in Etnom™, Microporous, Mylar™, Polypropylene, Prolene™, and Ultra-Polyester™
- Perforated roll at 3" lengths for a total of 1200 sheets available in Mylar™, Polypropylene, and Prolene™
- All films available in different thicknesses, from 1.5µm to 12µm

SpectroMembrane™

Key features

- Thin film sample support in a frame for easy handling and to avoid contamination
- Automatically detaches from carrier frame leaving a taut wrinkle-free sample support window.
- Packaged in 100's to match 100 Sample Cup Sets
- Available in Etnom™, Kapton™, Mylar™, Polypropylene, Prolene™, Ultra-Polyester™, and Zythene™
- Available in pre-set thicknesses, from 2µm to 12 µm

SpectroFilm™ Safety Secondary Window

Key features

- Self adhesive protective films
- Protects sensitive electronics from leakage such as, X-ray tube windows, X-ray detectors, windows, and electronics
- Eliminates contamination issues
- Prevents Costly clean-ups
- Available in Etnom™, Mylar™, and Prolene™
- Available in 2 standard sizes 1.38" (35mm) OD/ 0.78 (20mm) ID and 2.36" (60mm) OD/ 1.65" (42mm) ID

Thin Film Windows

ordering information

Select from the available material and sizes

Material	Thickness	Precut 500 or 1000 pack	Roll 91.4m	Roll 91.4m PrePerf	SpectroMembrane™ 91.4m	SpectroFilm™ 25 pack
Kapton™	7.5 µm	63.5mm	-	-	63.5mm & 76.2mm	-
Micropourous	25µm	63.5mm	76.2mm	-	-	-
Mylar™	2.5µm	3.5mm	76.2mm	76.2mm	63.5mm & 76.2mm	-
	3.6µm	63.5mm & 89mm	76.2mm	76.2mm	35mm, 63.5mm & 76.2mm	35mm OD/20mm ID 60mm
	6.0µm	63.5mm	76.2mm	76.2mm	63.5mm & 76.2mm	-
Polypropylene	6.0µm	63.5mm	76.2mm	76.2mm	45mm, 63.5mm & 76.2mm	-
	12.0µm	63.5mm	76.2mm	-	45mm, 63.5mm & 76.2mm	-
Prolene™	3.0µm	-	-	-	35mm, 63.5mm & 76.2mm	35mm OD/20mm ID 60mm
	4.0µm	63.5mm	76.2mm	76.2mm	35mm, 63.5mm & 76.2mm	-
Etnom™	1.5µm	-	-	-	-	-
	2.0µm	-	-	-	35mm, 63.5mm & 76.2mm	-
	2.5µm	-	76.2mm	-	63.5mm & 76.2mm	-
	3.0µm	-	-	-	63.5mm & 76.2mm	35mm OD/20mm ID 60mm
Ultra-Polyester™	1.5µm	-	-	-	76.2mm	-
Zythene™	6.0µm	-	-	-	63.5mm & 76.2mm	-

Grinding and Fusion Consumables

Fabricated and stored under environmentally controlled conditions to avoid introducing trace levels of contaminant, they are available in a variety of formats including rolls (continuous and perforated), pre-cut sheets, or supported in a card frame for ease of application.

Grinding and pelletizing additives

Key features

- X-Ray Mix™ pre-weighted tablets (1/4g) (composition C: 48.7%; O: 42.6%; H: 8.1%; B: 0.6%)
- SpectroBlend™ pre-weighted tablets (1/2g) (composition C: 81.0%; O: 2.9%; H: 13.5%; N: 2.6%)
- Boric Acid pre-weighted tablets (1/2g) (composition O: 77.6%; H: 4.9%; B: 17.5%)
- Liquid Binder™ for difficult-to-bond samples Polymer ingredient (C6H9ON) in methylene chloride solvent.
- X-Ray Mix™ and SpectroBlend™ also available in powder form.

FusionFlux™ borate fluxing agent

Key features

- Lithium Tetraborate ($Li_2B_4O_7$) based fluxes
- Blended with lithium bromide (LiBr) or lithium iodide (LiI) in blends from 0.5% to 1.5%
- Additional blends with 33% to 100% Lithium
- Metaborate ($LiBO_2$)
- Formulations with non-wetting agents
- See ordering information for blends

Other accessories

Key features

- Sample powder compactors to flatten and level surface before pelletization
- Sample storage pods with 5 or 10 pods: catalog, store and protect briquetted powder samples, metallographic specimens, gems, optical glasses and many other delicate items.

Grinding and Fusion Consumables

ordering information

CX600E	X-Ray Mix™, Powder; 1lb per bottle
CX625E	X-Ray Mix™, 1/4gm Tablets; 500 tablets per bottle
CX650E	X-Ray Mix™, 1/2gm Tablets; 500 tablets per bottle
CX660E	SpectroBlend™, 44µm Powder; 1lb per bottle
CX690E	SpectroBlend™, 1/2gm Tablets; 500 tablets per bottle
CX750E	Boric Acid, 1/2gm Tablets; 1000 tablets per bottle
CX800E	Liquid Binder™ Additive; 1 Pint
CX30-1000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 100% ($Li_2B_4O_7$); 1lb
CX30-1100E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent Lithium Tetraborate 99.5% ($Li_2B_4O_7$)/Lithium Bromide 0.5%, LiBr; 1lb
CX30-1200E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent Lithium Tetraborate 99.5% ($Li_2B_4O_7$)/Lithium Iodide 0.5%, LiI; 1lb
CX30-2000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Metaborate 100% ($LiBO_2$); 1lb
CX30-2100E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent, Lithium Metaborate 99.5% ($LiBO_2$)/Lithium Bromide 0.5% (LiB); 1lb
CX30-2150E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent, Lithium Metaborate 98.5% ($LiBO_2$)/Lithium Bromide 1.5% (LiB); 1lb
CX30-3000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 80% ($Li_2B_4O_7$)/ Lithium Metaborate 20% ($LiBO_2$), 1lb
CX30-4000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 67% ($Li_2B_4O_7$)/ Lithium Metaborate 33% ($LiBO_2$), 1lb
CX30-4100E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent Lithium Tetraborate 66.67% ($Li_2B_4O_7$)/Lithium Metaborate 32.83% ($LiBO_2$)/Lithium Bromide 0.5% (LiB), 1lb
CX30-4200E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent Lithium Tetraborate 66.67% ($Li_2B_4O_7$)/ Lithium Metaborate 32.83% ($LiBO_2$)/Lithium Iodide 0.5% (LiI), 1lb
CX30-5000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 50% ($Li_2B_4O_7$)/ Lithium Metaborate 50% ($LiBO_2$), 1lb
CX30-5100E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent, Lithium Tetraborate 49.75% ($Li_2B_4O_7$)/Lithium Metaborate 49.75% ($LiBO_2$)/Lithium Bromide 0.5% (LiB) 1lb
CX30-5200E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent, Lithium Tetraborate 49.75% ($Li_2B_4O_7$)/ Lithium Metaborate 49.75% ($LiBO_2$)/Lithium Iodide 0.5% (LiI) 1lb
CX30-6000E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 35% ($Li_2B_4O_7$)/ Lithium Metaborate 65% ($LiBO_2$); 1lb
CX30-6600E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation Lithium Tetraborate 66% ($Li_2B_4O_7$)/ Lithium Metaborate 34% ($LiBO_2$); 1lb
CX30-6650E	SpectroCertified™ Pre-Fused FusionFlux™ Formulation with Non-wetting agent, Lithium Tetraborate 34.83% ($Li_2B_4O_7$)/Lithium Metaborate 64.67% ($LiBO_2$)/Lithium Bromide 0.5% (LiB) 1lb
CX2513E	PelletCups™ Powdered Sample Compactors; 13mm Dia.
CX2532E	PelletCups™ Powdered Sample Compactors; 32mm Dia.
CX2535E	PelletCups™ Powdered Sample Compactors; 35mm Dia.
CX2540E	PelletCups™ Powdered Sample Compactors; 40mm Dia.
CX2545E	PelletCups™ Powdered Sample Compactors; 45mm Dia.
CX2030-10E	Sample Storage Kit with 10 Sample Pods
CX2030-1E	Sample Pod Replacement (single pod)
CX2030-5E	Sample Storage Kit with 5 Sample Pods

Spectroscopist's Hints and Tips

The following hints and tips on infrared sampling may help you achieve better spectra with greater ease. Don't forget to contact your local Specac representative if you need any help with your application. Contact details are listed at the back of this catalogue.

Sample preparation

For the preparation of halide disks, pestles, mortars and KBr powder should be stored in a dry environment such as the Specacabinet. The equipment should be used while still warm to minimize water contamination of the disk.

A good approximation for "first time right" halide disks is to choose a weight-to-weight ratio of 1% sample to 99% KBr. This approximation is good for most organic materials.

Don't take shortcuts by insufficient grinding of halide disk constituents. The target particle size is 0.025 mm, to coincide with the wavelength of light in the classical mid-infrared region.

Fold a sheet of paper in half to make a simple funnel for swift and easy transfer of the groundup halide disk constituents into the pellet dies.

Take the time to use a vacuum pump with evacuable pellet dies when producing halide disks. The resulting higher quality disks produce improved spectra.

If a finished halide disk absorbs too strongly, there is no need to start again completely.

Simply break off a small piece and regrind with additional KBr. When using diamond compression cells it is worth checking to see if the sample has preferentially adhered to just one of the windows.

If so, use the one window only for improved spectral quality. Always run background data for both one and two windows in anticipation of this.

When using liquid transmission cells in quantitative measurements it is useful to check the pathlength before and after an experiment. This is especially helpful with demountable cells.

Try using two syringes, one in each cell port, when filling and emptying liquid transmission cells. This helps to prevent air bubbles in the liquid film, and is especially useful when using very thin spacers.

Whilst doing a series of concentration solutions it is advisable to change the sample via the filling ports rather than dismantling the cell.

Concentration contamination effects are avoided in quantitative work by analyzing the sample set in increasing order of concentration.

Typical transmission pathlengths for organic solvent based solutions are as follows:

Analytical concentration	Typical pathlength
> 10 %	0.05 mm
10 % – 1 %	0.1 mm
1 % – 0.1 %	0.2 mm
< 0.1 %	> 0.5 mm

Spectroscopist's Hints and Tips

Reflection measurements

Two ways of reducing the ATR penetration depth into a strongly absorbing sample are choosing an ATR crystal with a higher refractive index (see the list of optical material properties at the back of this catalogue), and selecting a larger angle of incidence.

When analyzing powdered samples using ATR, pre-grinding the sample will improve the homogeneity of the sample particles, and yield better spectra.

Aerosol spray samples can be conveniently analysed using the ATR technique. Spray the contents onto a flat or trough top-plate, in a fume cupboard, away from the spectrometer compartment.

Lacquers and coatings can be analysed for specular reflectance in the following way. Wrap aluminium foil (shiny side out) around the reference mirror and apply the coating. Allow to dry and record spectra of the resulting film.

When using diffuse reflectance the sample heights are not alway uniform. Each time the sample is changed it is desirable to reach the optimum height and peak energy as quickly as possible. A rolling micrometre on the Specac Minidiff Plus accessory adjusts the height in seconds, without using tools.

Level the surface of a sample for diffuse reflectance measurement by gently tamping down the surface, using a glass slide resting on the surface under its own weight. Do not press the surface hard, and risk compacting the sample. The surface can be seen through the glass slide.

Spectroscopist's Hints and Tips

Transmission measurements

Always wear gloves when handling all infrared windows to avoid contamination. This is good practice even for non-hygroscopic windows.

For accessories that are, or maybe, out of alignment, a small beam white light source is ideal for recreating the beam path. Once rough alignment has been recovered, use the energy level output on the spectrometer in order to fine tune the signal.

Test the identity of an unknown window or crystal by measuring the transmission characteristics in the spectrometer. Be aware that the cut-off values quoted in transmission characteristics tables are typically for short pathlengths of a few millimeters. Longer paths through ATR crystals will reduce the absorption cut-off back towards shorter wavelengths.

When using a temperature controlled accessory, always remember to set the temperature to 20°C after use. This will remove the risk of accidentally heating the accessory the next time it is switched on.

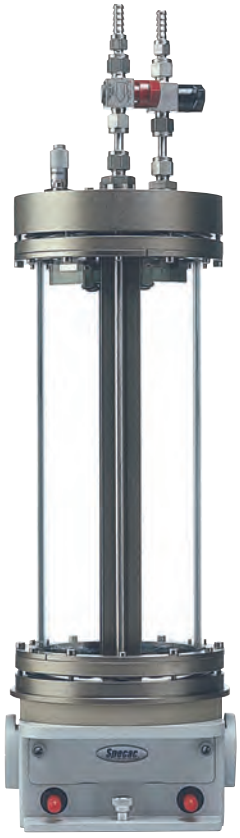
Always check the chemical compatibility of a window or crystal material by using scrap fragments. If in doubt, contact your local Specac representative for assistance.

When cleaning accessory optics it is advisable to remove the accessory from the spectrometer. If this is undesirable, be economical with the amount of solvent used, as large amounts of solvent vapour can have an effect on subsequent spectra. It is also advisable to purge the accessory before use.

Choosing Fluorolube as a mulling agent allows the study of all CH stretching bands in an infrared spectrum using the mull technique. These are masked by paraffin absorptions when using Nujol.

The use of an O-ring on the plunger body of an evacuable pellet die prevents the plunger falling onto the newly pressed disk when removing the disk from the body of the die.

Fingerprints can be removed from mirrors by slowly dragging a methanol soaked lens tissue over the surface of the mirror. Use a stream of dry air to remove excess solvent.



Pharmaceutical comparison

SPECAC APPLICATION NOTE

IR spectroscopy is a well established technique to identify and distinguish samples in the gas, solid and liquid phases.

A sample is typically sandwiched between two windows, separated by a known pathlength.

Potassium bromide (KBr, spectroscopic grade) is typically used as the window material because it is transparent in the IR, between 4000–400 cm^{-1}.

Alternatively, samples can be contained within a KBr matrix and pressed to form a pellet that is then analysed.

This paper compares the IR spectra of 7 mm and 13 mm diameter pellets of three pharmaceutical samples, shown in Table 1.

Sample	Sample	Sample	Figure
Buscopan	Powder	$C_{21}H_{30}NO_4^+$	1
Levothyroxine	Powder	$C_{15}H_{11}I_4NO_4$	2
Omeprazole	Powder	$C_{17}H_{19}N_3O_3S$	3

Equipment and Method

Samples were ground in an agate pestle and mortar. A small amount (1 wt%) was mixed with an excess of KBr powder (99 wt%) and ground down again to form a uniform consistency.

Aliquots of the mixture were used to make the 7 mm and 13 mm diameter pellets for each sample.

The IR spectra of both pellet sizes for each sample were recorded using an FTIR spectrometer at standard room temperature with a resolution of 4 cm^{-1}.

The Specac Basic Solid Pack was used to make the 7 mm diameter KBr sample pellets with a 2T Mini-Pellet press.

The Specac Advanced Solid Pack, with its 13 mm Evacuable Pellet Die and a 15T Manual Hydraulic Press, was used to make the 13 mm diameter KBr pellets.

Discussion

The transmission spectra for 7 and 13 mm pellets of Buscopan, Levothyroxine and Omeprazole are presented in Figures 1, 2 and 3 respectively.

For each sample, there is excellent agreement with respect to relative peak intensity and position, regardless of the pellet size used.

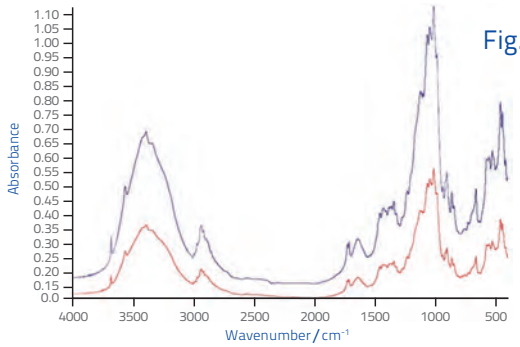


Fig. 1

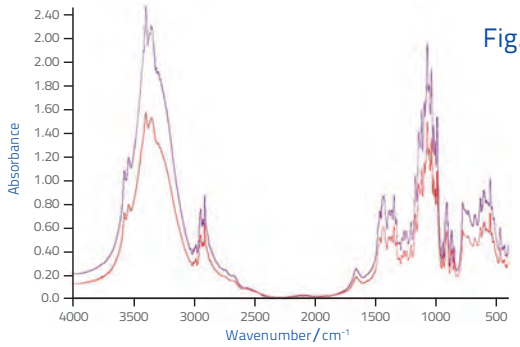


Fig. 2

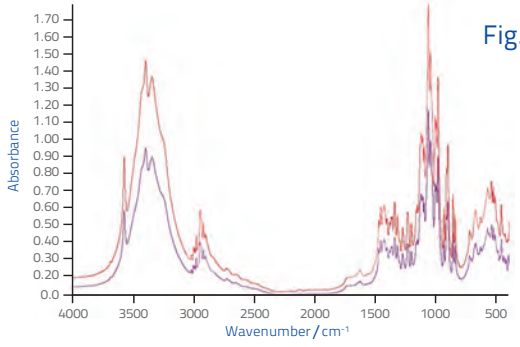


Fig. 3

CONCLUSION

For each sample, the IR spectra for both pellet sizes showed no differences in their qualitative and quantitative interpretations.

Optical Materials for Spectroscopy

Window material	Range from	Range to	Refractive Index at 2000cm^{-1}	General Properties
MgF_2	91,000	1,100	1.37	Almost insoluble in water. Hard material suited to relatively high pressure applications. Bi-refringent and subject to thermal shock. Should not be used above 500°C.
LiF	83,000	1,400	1.33	Slightly water soluble. Hard, brittle material. Subject to thermal shock. Should not be used above 400°C.
CaF2	77,000	900	1.40	Insoluble in water, resists most acids and alkalis. Soluble in ammonium salts. Its high mechanical strength makes it particularly useful for high pressure work. Sensitive to mechanical and thermal shock. Does not fog.
BaF2	66,666	800	1.45	Insoluble in water, soluble in acids and NH4Cl. Very sensitive to mechanical and thermal shock. Good resistance to fluorine and fluorides. Does not fog.
NaCl	40,000	600	1.52	Soluble in water and glycerine. Slightly soluble in alcohols. Fair resistance to mechanical and thermal shock and can be easily polished.
AMTIR	11,000	725	2.50	Amorphous material which transmits infrared radiation. A chalcogenide glass which although relatively hard is brittle. Insoluble in water, resistant to acid but attacked by alkalis.
AgBr	22,000	300	2.30	Insoluble in water, soluble in acids and NH4CL. Very sensitive to mechanical shock and is malleable. Will cold form. Good resistance to thermal shock. Corrosive to metals and alloys. Sensitive to strong UV radiation and will darken with long exposure.
KCl	33,000	400	1.40	Hygroscopic material similar to NaCl but with extended transmission range. Less soluble and lower reflection losses.
KBr	43,500	400	1.54	Hygroscopic material similar to NaCl. Soluble in water, glycerine and alcohols. Slightly soluble in ether. Fairly good resistance to mechanical and thermal shock.
KRS-5	17,000	250	2.38	This material is a mixture of Thallium Bromide and Thallium Iodide salts and is extremely toxic. Orange/red in colour. Slightly soluble in water, soluble in bases, but not soluble in acids. Not hygroscopic.
CsBr	42,000	250	1.66	Hygroscopic material. Soluble in water and acids. Soft, hence easily deformed.
CsI	42,000	200	1.74	Extremely hygroscopic material. Soluble in water and alcohols. Useful because of wide transmission range. Mildly toxic.
Silica SiO_2 UV Grade	59,000	3700	1.46	Resistant to acids and alkalis and unaffected by most solvents. Transmission at 50,000cm^{-1} is 98% for UV grade and 40% for IR grade.
Silica SiO_2 IR Grade	40,000	3000	1.46	Resistant to acids and alkalis and unaffected by most solvents. Transmission at 50,000cm^{-1} is 98% for UV grade and 40% for IR grade.
ZnS (Cleartran)	50,000	770	2.25	Insoluble in water, normal acids and bases and virtually all organic solvents. Reacts to strong oxidising agents. Good resistance to thermal and mechanical shock. Suitable for work in temperature range -200°C to 800°C.
ZnSe	20,000	500	2.43	Toxic, hard and brittle material. Amber/yellow in colour. Insoluble in water, but attacked by strong acids and bases (pH range 4 to 11 tolerant). Organic solvents have no effect. Ideal for ATR work.
Ge	5,000	550	4.01	Hard and very brittle material. Is temperature sensitive and loses transmission when heated. Optically opaque at 190°C. Insoluble in water. Soluble in hot sulphuric acid and aqua regia. Suitable for ATR work where high pressure contact is not required.
Diamond	40,000	10	2.40	Very hard and extremely chemically resistant. A diamond window is often chosen for high pressure applications. Excellent for ATR work.
Si	8,333	33	3.42	Very hard, but brittle and relatively inert material. Is attacked by a combination of HF and HNO3. Withstands thermal shock. Useful for Far IR. in the region 400-30cm^{-1}.
Poly-ethylene	625	4	1.52	Inexpensive Far IR window material. Insoluble in water but tends to swell and be contaminated with some organic solvents. Melting point 110°C.

A-Z of IR

100% Line
Ratio of two background spectra under identical conditions. Determines condition of spectrometer, or accessory, and quality of spectra. An ideal 100% Line would be a horizontal line at 100%.

A

Absorbance
The amount of Infrared radiation absorbed by a sample. It is proportional to concentration, and is defined by Beer's Law, so it can be used for Quantitative Analysis. Often the Y-axis unit in Infrared spectra, absorbance is related to transmittance by A=log10 (1/T), where A is the absorbance and T is the transmittance.

Attenuated Total Reflectance (ATR)
A reflectance sampling technique, used in such accessories as the Golden Gate® and the Benchmark™ 6 Reflection ATR System. A beam of Infrared radiation is passed through a prism of material which is Infrared transparent, and has a high refractive index, at least higher than the sample being analyzed. Due to internal reflectance, the light reflects off the surface of the crystal at least once, setting up an evanescent wave, which extends into the sample by typically a few microns. The sample must be held in intimate contact with the crystal.

B

Background Spectrum
A single beam spectrum produced without a sample in the Infrared beam. It is used to record the contributions that the instrument and the environment make to the measurement. The sample spectrum can be ratioed against the background spectrum to remove these contributions.

Baseline correction
The manipulation of a spectrum to correct a sloped or curving baseline. The spectroscopist draws a function parallel to the baseline which is then subtracted from the spectrum.

Beamsplitter
An optical device which reflects half the radiation striking it, and transmits half.

Benchmark™ system
Specac's universal compatibility baseplate system, adapting Specac accessories to all spectrometer models. Also Specac's 6 Reflection ATR System, capable of analyzing almost any sample.

C

Calibration
In Quantitative Analysis, the correlation of peak heights and areas in a spectrum with the concentrations of standard analytes. After calibration, unknown analyte concentrations can be calculated.

Calibration curve
An Absorbance vs. Concentration plot used in calibration. If the sample obeys Beer's Law, the plot will be linear and unknown concentrations can be calculated.

Condenser
The optical element that condenses light on a sample.

Critical Angle
Defined as being: c = arcsin (n1/n2)
where 'c' is the critical angle for an interface between two specific media, n1 and n2 are the refractive indices of the two media and n 2 has the higher refractive index; the critical angle is the smallest angle of incidence at which total internal reflection occurs.

D

Depth of Penetration
When a sample is analyzed using ATR, the depth of penetration is the depth at which the evanescent wave has decreased to 1/e (or 36.788%) of its original value after penetrating the sample. The depth of penetration is dependent on many factors, including the angle of incidence, the refractive index of the ATR crystal, and the wavelength of the Infrared radiation.

A-Z of IR

Diffraction
The bending of light around the edge of an opaque body, or through a narrow slit, resulting in a series of alternately high and low intensities in the shadow of the obstacle.

Diffuse reflection
The random reflection resulting when a beam of light reflects off a rough, matt surface e.g. powder or fibre.

Dispersive Instruments
Infrared spectrometers that use a grating or prism to disperse Infrared radiation into its component wavelengths before detecting them. This type of instrument is less widespread since the arrival of FT-IR spectrometers.

DRIFTS (Diffuse Reflectance Infrared Fourier Transform Spectroscopy)
A reflection sampling technique making use of the phenomenon of diffuse reflectance.

E

Evanescent wave
A standing wave of radiation set up in an ATR crystal at the interface with the sample. The wave penetrates into the sample and an Infrared spectrum can be obtained.

F

Far IR
Infrared radiation between 400 and 10 cm-1.

Fluorolube
Polymer of trifluorovinyl chloride (-CF_2-CFCl-)x used for the preparation of mulls. Unlike Nujol, it doesn't mask CH stretch bands.

Fourier Transform
The integration performed upon an interferogram to produce an Infrared spectrum.

Fourier Transform Infrared (FT-IR) Spectrometer
The instrument used for FT-IR spectroscopy.

FT-IR Spectroscopy
A method of obtaining an Infrared spectrum by measuring the interferogram of a sample using an interferometer, then performing a Fourier Transform upon the interferogram to obtain the spectrum.

G

Germanium
Element, atomic number 32, atomic weight 72.6: a gray-white metallic semiconductor. Its high refractive index (4.01) makes it an important material for ATR crystals, used to analyze highly absorbing samples.

Golden Gate®
Specac's world-famous single reflection ATR accessory, analyzing almost all sample types: hard solids, to powders, to corrosive liquids, to fibres. The Golden Gate® is the world's most versatile sampling system. The standard Diamond Golden Gate® uses a type IIa diamond as the ATR element for unparalleled optical sensitivity, while diamond's unique physical strength makes it ideal for excellent contact with the hardest of solids. Its tremendous chemical stability allows it to withstand corrosive liquids.

Other Golden Gate® versions available, to accommodate various types of sample, include a Germanium Golden Gate®, whose high refractive index is useful for highly absorbing samples, and a heatable version for high temperature analysis.

Grazing angle reflection
An optical phenomenon occurring when the incident Infrared radiation strikes a sample, deposited on a reflective material, at an angle of around 80° to the normal. Useful for the analysis of thin coatings, e.g. paints on metallic surfaces.

I

Index of refraction
A property of a material describing the behaviour of electromagnetic radiation when travelling through it (not all EM radiation can travel through all materials). It is defined as being the ratio of the speed of light in a vacuum to the speed of light in the material concerned. Also called refractive index.

A-Z of IR

Infrared (IR) radiation
The region of the electromagnetic spectrum from 14,000 to 10cm^{-1}.

Infrared Spectroscopy
The study of the characteristic Infrared spectra of matter.

Infrared spectrum
A plot of Intensity of Infrared radiation vs. Wavenumber. A spectrum can be interpreted to determine the molecular structure of the sample from which it has been obtained, because different functional groups in a molecule will each produce a unique feature, or fingerprint, in the spectrum.

Interferogram
A plot of Infrared detector response vs. Optical path difference. This is what an FT-IR spectrometer measures, to be Fourier Transformed to obtain a spectrum.

Interferometer
An optical device causing two beams of light to travel different distances to produce an optical path difference. This allows constructive and destructive interference to occur, and changing the optical path difference allows measurement of an interferogram.

Internal reflection
The effect where electromagnetic radiation passing through a material reflects off the surface of the material at the interface with another medium, which has a lower refractive index, instead of leaving the material to enter the new medium. If the angle of incidence is larger than the critical angle, then none of the light will be transmitted to the new medium, it will all be reflected. This phenomenon is called total internal reflection.

K

KBr pellet
A pellet produced for use in transmission analysis. This technique is used for powders and other solids. The sample is ground, then "diluted" with KBr powder, before being pressed into a pellet. The pellet is then mounted on a Specacard before being placed directly in the Infrared beam for analysis.

Kramers-Kronig Transform
A mathematical calculation performed upon specular reflectance spectra to eliminate the effect of variations in the refractive index of the sample. It results in ak-spectrum and an n-spectrum, which are the true absorbance spectrum and a plot of refractive index vs. wavenumber respectively.

KRS-5
Trade name for thallium iodide bromide, a common ATR crystal material (refractive index 2.38) with Near IR and Mid IR transmission characteristics.

Kubelka-Munk units
Unit of intensity of diffuse reflected light. The Kubelka-Munk equation relates this intensity to the concentration and scattering factor of a sample. The scattering factoris determined by the particle size, shape and packing density, but can be difficult to quantify.

M

Micrometre
A gauge for accurately measuring small distances, thicknesses etc.

Mid IR
Infrared radiation between 4,000 and 400 cm-1.

Mull
A Transmission sampling technique. A solid sample is ground, then dispersed in a mulling agent (e.g. Nujol). The mull mixture is then sandwiched between two windows (e.g. KBr) in an Omni-Cell™ body before being placed directly in the Infrared beam.

Mulling agent
(Usually) an oil added to a ground sample in the preparation of a mull.

N

Near IR
Infrared radiation between 14,000 and 4,000cm-1.

Nujol
A liquid paraffin used for the preparation of mulls. Nujol is not always the best mulling agent as it masks any CH stretch bands that would otherwise be seen in the sample spectrum.

A-Z of IR

Omni-Cell™
With over 400 window and pathlength combinations available as standard, to cater for every sample and wavelength of interest, Specac's Omni-Cell™ is the simple stand most versatile Infrared transmission cell system available anywhere. The Omni-Cell™ can be configured as a sealed liquid cell, a demountable liquid cell, or a mull cell. Easily assembled, or disassembled, in a few seconds, it is designed for fast sample turn-around. With a known pathlength, the spectrum from an Omni-Cell™ is suitable for Quantitative Analysis.

P

Peak-to-Peak Noise
A noise measurement often made on a 100% Line to determine spectrum quality and instrument performance when obtained under controlled conditions. It is measured as the difference between the lowest and highest transmittance value in a specific wavenumber range.

Polarizer
A device for converting light into polarized light. Typically, polarizers are a ZnSe substrate with thin parallel gold wires on the surface to form a grid.

Polymer film
A thin film, of precise thickness, pressed at an elevated temperature using a Specac Constant Thickness Film Maker Kit. The film can then be mounted in a magnetic film holder before being placed directly in the Infrared beam for transmission analysis.

Q

Quantitative Analysis
Calculation of sample concentration using measurements from a spectrum, such as band ratios and peak areas and heights.This technique requires a calibration before unknown concentrations can be determined.

R

Raman effect
When monochromatic light is scattered by molecules, a small fraction of the scattered light is observed to have a different frequency from that of the incident beam; this is the Raman effect. Raman spectroscopy can reveal vibrations that may be inactive under Infrared analysis, and therefore can provide complementary information about the molecular structure of the sample under examination. The Specac Variable Temperature Cell holder is suitable for the Raman Technique

Reflection Absorption
Also known as "Double-transmission", reflection absorption is a sampling technique used on thin coatings on metal. The Infrared beam passes through the coating again after reflecting off the metal surface, before reaching the detector.

Refractive Index
See Index of Refraction.

Resolution
Measure of the ability of a spectrometer to distinguish features of a spectrum which are very close together.

S

Scan
The measuring of an interferogram in FT-IR. Usually involves cycling the mirror in the interferometer once.

Sealed Liquid Cells
Basic accessories used to obtain transmission spectra of liquids. Consists of two IR transparent windows (e.g. NaCl), held apart by a spacer, filled with the liquid under consideration. The cell is then put directly into the beam. Specac's advanced Omni-Cell™ system can be configured for use as a sealed liquid cell, with 9 options for windows and 6 options for pathlength to give 54 standard combinations.

The Selector™
Specac's versatile diffuse reflectance accessory, featuring unique off-axis optics to fully minimize unwanted specular reflectance, offers rapid FT-IR analysis of solids with minimal sample preparation. The Selector™ can include an Environmental Chamber, for extreme temperature and pressure analyses.

A-Z of IR

Signal-to-Noise Ratio (SNR)
To determine the quality of a spectrum, or spectrometer, the SNR is the ratio of the signal, or intensity, of the spectrum to the noise at a nearby point on the baseline.

Silicon
Element, atomic number 14, atomic weight 28.09, grayish metallic semiconductor. A very hard, inert crystal with a refractive index of 3.42, Silicon is very useful for Far IR in the range 400 to 30cm^{-1}.

Single Beam Spectrum
The spectrum obtained after Fourier Transforming an interferogram. The single beam spectrum is a combination of the spectra of the sample (if applicable), the instrument and the environment.

Specac Gas Cell
Specac's advanced transmission gas analysis cell is a new concept in gas cell specification. With an extensive array of standard features on the base unit, personalized modifications can be made from a range of precision engineered options. A range of pathlength options allows analysis at low pressures to be performed in the longer cells, and pathlengths can be verified with a laser alignment accessory.

Specacard™
Mount for the transmission analysis, and storage, of KBr pellets. Specacards can also be used, with a magnetic film holder, for polymer films.

Specular Reflectance
The reflectance occurring when a beam of light strikes a smooth, shiny surface, e.g. a mirror, such that the angle of incidence equals the angle of reflection. Specular reflectance can be used to obtain Infrared spectra.

T

Transmission
A physical phenomenon where radiation passes through a body.When producing a transmission spectrum a proportion of the energy is absorbed by the sample, while the remainder travels on to the detector.

Transmission Sampling
The method of sampling whereby the Infrared beam passes directly through the sample before being detected, used in such accessories as the Variable Temperature Cell holder, the Omni-Cell™ and the Long Pathlength Series Gas Cell. An appropriate pathlength must be selected so as to avoid total absorption of the Infrared.

Transmittance
Unit of measurement of the amount of radiation transmitted by a sample. It is often the Y-axis of Infrared spectra. Transmittance is not linearly proportional to the concentration of the sample, therefore spectra plotted with these units cannot be used for Quantitative Analysis.

V

Variable Temperature Cell holder
Specac's most advanced accessory for the transmission analysis of liquids and solids at temperatures from -190°C to 250°C. Choice of window material allows this accessory to be used in UV, Visible and Infrared regions. This accessory can also be used for Fluorescence and the Raman Technique.

W

Wavelength
One wavelength is the distance between two identical points on two adjacent identical waves in a beam.

Wavenumber
Wavenumber is defined as the reciprocal of the wavelength expressed in cm. Units are cm-1. Wave numbers are normally the units along the X-axis in Infrared spectra.

Index

Notes

inside back cover

Specac

Product Catalogue 2018-19

UK
Specac Ltd.,
River House, 97 Cray Avenue,
Orpington, Kent, BR5 4HE U.K.
T: +44 16 8987 3134
F: +44 16 8987 8527
sales@specac.co.uk

USA
Specac Inc.,
414 Commerce Dr., Suite 175,
Fort Washington,
PA 19034 U.S.A.
T: +1 86 6726 1126
sales@specac.co.uk

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www.specac.com