Quantum Design
OXFORD

Optistats

Automated & Compact Optical Cryostats for Spectroscopy

Key Features

- ✓ Excellent temperature control
- ✓ Fully automated
- ✓ Fast cooldown times
- ✓ User exchangeable window options
- ✓ Wide temperature ranges
- ✓ Most economic running costs
- ✓ Solid, powder & liquid samples

Key Applications

- ✓ FTIR spectroscopy
- ✓ THz spectroscopy
- ✓ UV/visible reflectivity & absorption
- ✓ Photo/Electroluminescence
- ✓ Raman scattering
- ✓ Electrical transport measurements
- ✓ Ultrafast spectroscopy

qd-oxford.com

Introducing our Optical Cryostat Range

Our easy to use, compact and efficient Optistat cryostats offer a wide range of options to suit most spectroscopy applications. They provide a wide temperature range (from 2.2 K up to 500 K) while providing excellent optical access. The Optistat model of choice will depend on the base temperature, cooling technology and sample environment required for your experiments.

The Optistat System

✓ Full system integration and control

All systems are fully configured to provide optimum cryogenic performance. Sample holders are included for both reflection and transmission experiments. Where applicable, cuvette holders are available for powdered and liquid samples.

An extensive range of interchangeable windows are available for spectroscopy from near ultraviolet to extreme infrared, providing flexibility and adaptability for current and future applications.

✓ Intelligent cryogenic environmental controller

The MercuryiTC intelligent temperature controller combines multiple instruments into one, allowing for accurate temperature control at the heat exchanger and automated gas flow control. Plug and play expansion cards for additional sensor and heater channels, proportional integral derivative (PID) loops, stepper motor control and communication cards allow for full customisation. All functions can be accessed through the touch screen front panel, remotely or integrated into your own software scripts.

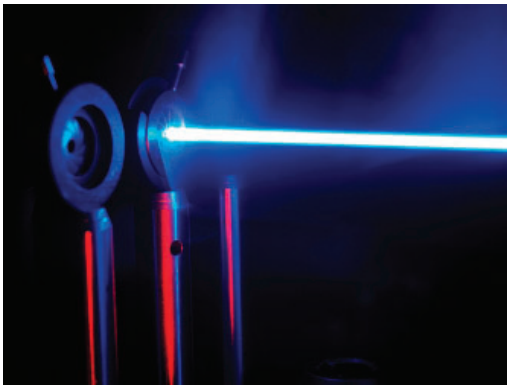
	Optistat Model					
	DN		CF[†]		Dry[‡]	
	DN-X	DN-V	CF-X	CF-V	TLEX	BLV
Temperature range	77.2 – 500 K	77.2 – 500 K	2.2 – 500 K*	2.3 – 500 K*	< 4 – 300 K**	< 3 – 300 K**
Cooling technology	Nitrogen only	Nitrogen only	Helium or Nitrogen	Helium or Nitrogen	Cryofree®	Cryofree®
Sample environment	Static exchange gas	Vacuum	Static exchange gas	Vacuum	Static exchange gas	Vacuum
Temperature stability (period)	±0.1 K (10 min)					
Maximum sample space	20 mm Ø			30 mm x 58 mm	20 mm Ø	40 mm x 50 mm
Sample holder dims	19 mm x 30 mm	20 mm x 50 mm	19 mm x 30 mm	20 mm x 50 mm	119 mm x 30 mm	20 mm x 50 mm
Cooldown time from room temperature	20 mins		10 mins		6 hrs	<2.5 hrs (200), <3 hrs (12P)
Vibration	n/a		<0.1 µm***		<10 µm RMS***	
Customer wiring	10 DC				24 DC	20 DC (200), 12 DC (12P)

[†] Lower temperature depends on pump selection.
[‡] Lowest temperature achieved with window blanks fitted. Final base temperature will vary with number of windows and materials fitted.
* Base temperature with rotary pump option
** Base temperature with blanked window ports
*** Typical, in conjunction with local vibration mitigation practices

Application Focus

Infrared/FTIR/THz Spectroscopy

Infrared and Terahertz spectroscopy, widely used for polymer research, inorganic chemistry, pharma or drug related research, as well as solid state and semiconductor physics, can be studied with the use of CaF_2, ZnSe or TPX windows fitted to the Optistat range of cryostats. Since the Optistat windows are user-changeable, this allows for a great level of versatility across a wide range of transmission wavelengths.

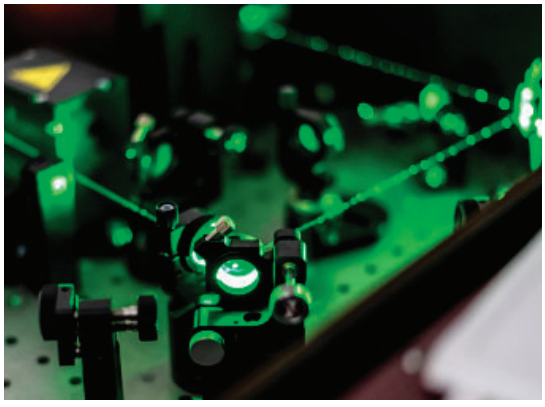


Raman Spectroscopy

The Optistat range allows for Raman analysis of a wide range of materials including gases, liquids, and solids. Highly complex materials such as biological organisms and human tissue can also be analysed by Raman spectroscopy using the sample-in-exchange gas models and range of sample holders.

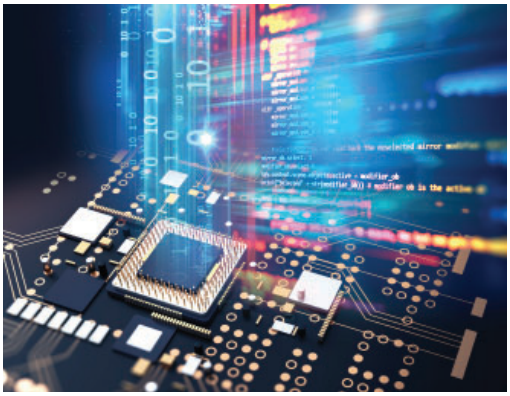
Ultraviolet–Visible Spectroscopy

Ultraviolet–visible spectroscopy or UV/VIS refers to absorption spectroscopy or reflectance spectroscopy in the ultraviolet-visible spectral region. Optistat systems are available with a wide range of window materials, including Spectrosil B/WF for UV/Vis wavelengths



Photoluminescence

Photoluminescence (PL) is commonly used for investigating semiconductors that can be studied at room temperature. At low temperatures, spectral lines are sharper and more intense, revealing more structure. The wide range of temperatures offered by the Optistat range allow for the detection of excitations normally masked by the high thermal phonon background at room temperature.

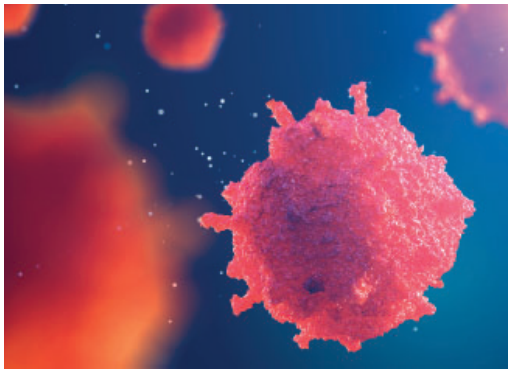


Photoreflectance

Photoreflectance (PR) is a very sensitive optical probe method on the electronic structure of semiconductors, especially for the band-edge structure and discrete level in the band gap. Through a modulated laser pump, the reflectance signal of the sample responds sharply at critical points around the band edge and in the band gap. An Optistat cryostat provides a wider temperature range allowing for the extraction of more supplementary information such as ionisation energy.

Fluorescence Spectroscopy

Fluorescence spectroscopy, analyses fluorescence from a sample, and is a popular application for the Optistat DN/CF range. With the fast sample change in the sample-in-exchange gas cryostats, they can be used in physics, biochemical, medical, and chemical research fields for analysing organic compounds. Many companies also offer compartment adaptors for their spectrometers to interface with the Optistat range of cryostats.



Optistat DN

Easy to use Nitrogen Bath Cryostats

This nitrogen cryostat is ideal for experiments which require 77.2 K base temperature with a small footprint, simple operation and excellent optical access to your samples.

Features	Benefits
Superb temperature control	✓ Wide temperature range: from 77.2 K to 500 K.•[1] ✓ Economical use of cryogens with long hold times at 77 K >15 hrs. ✓ Full PID control allowing for accurate target temperatures, defined ramp rates and elimination of overshoot.
Superb optical access	✓ Superb optical access (f/1) for measurements requiring light collection. ✓ Optimised clear beam throughput (15/35 mm diameter aperture for X and V configurations respectively) allows a large illumination area for measurements involving the detection of low intensity light.
Compact	✓ Compact size allowing easy integration into commercial spectrometers.
Great connectivity	✓ Electrical measurements via 10-pin electrical feed wire to heat exchanger.
Versatile	✓ Wide range of sample holders and sample rods, including fixed, simple and precise height and rotate adjust.

Specifications	DN-X	DN-V
Sample environment	Exchange gas	Vacuum
Temperature range	77.2 - 500 K•[1]	77.2 - 500 K
Temperature stability (period)	+/-0.1 K (measured over 10 mins)	
Maximum sample space	20 mm diameter	20 mm diameter
Sample holder dimensions	19 mm wide x 30 mm long	20 mm wide x 50 mm long
Cool down from ambient to 77.2 K	20 mins	
Liquid Nitrogen capacity	1.2 L	
Hold time at 77 K	>15 hrs	

Creating the Optimum Product for you

Step 1.

Build your Cryostat

Select from the following options to build your specific product order code. Example code shown.

OS-DN-X3-0-100

OS-DN-□-□-□

Cryogen	Code
Liquid Nitrogen	DN
Sample Environment (Max temp)	**Code**
Sample in exchange gas (300 K)	X3
Sample in exchange gas (500 K)	X5
Sample in Vacuum (500 K)	V5
Transfer Line	**Code**
NA	0
Wiring	**Code**
10 DC wires (10 pin)	100
10 DC wires + 2 Coax cables*	102
2 Coax cables‡	002

* X models only ‡V models only

Fast-track Configurations

OS-DN-X3-0-100

4 x Spectrosil WF windows fitted radially

OS-DN-V5-0-100

4 x Spectrosil WF windows fitted radially

Step 2.

Add standard controller, please see page 14 for additional controller options.

Description	Order Code
Mercury iTC Controller (Base unit). Inc. 1 x sensor/heater PID control loop	MERC-ITC-000

Steps 3 & 4

Accessories

A full range of accessories suitable for your cryostat are available on page 12.

Window Options

Every cryostat is supplied with 4 x Spectrosil WF windows, fitted radially, and 1 x blank fitted axially. All windows are user changeable. A selection of window materials with varied transmission properties are available. Please see the Windows information on page 16.

Optistat CF

Compact and Efficient Continuous-Flow Helium Cryostats

With the lowest helium consumption on the market, Optistat CF is ideal for a wide temperature range while providing excellent optical access to your samples.

Features	Benefits
Superb temperature control	✓ Wide temperature range: from 2.2 K to 500 K.•[1] ✓ Offering the most efficient use of helium with 0.45 L/hr for the CF-V and 0.55 L/hr for the CF-X, lowering the overall cost of ownership. ✓ Full PID control allowing for accurate target temperatures, defined ramp rates and elimination of overshoot.
Superb optical & sample access	✓ Superb optical access (f/0.9-f/1.0) for measurements requiring light collection in sensitive samples, with less laser power. ✓ Optimised clear beam throughput allows a large illumination area for measurements involving the detection of low intensity light. ✓ Quick sample change in less than 5 minutes via top-loading sample probe (CF-X).
Compact	✓ Compact size allowing easy integration into commercial spectrometers.
Great connectivity	✓ Electrical measurements via 10-pin electrical feedthroughs and optional miniature coax cables to the pins above the sample position.

Specifications	Optistat CF-X 'pull' mode	Optistat CF-X 'push' mode	OptistatCF CF-V 'pull' mode	OptistatCF CF-V 'push' mode
Sample environment	Exchange gas		Vacuum	
Temperature Range	2.3-500 K	4.2-500 K	2.3-500 K	4.2-500 K
Temperature stability (period)	+/-0.1 K (measured over 10 mins)			
Maximum sample space	20 mm diameter		30 mm wide x 58 mm long	
Sample holder dimensions	19 mm wide x 30 mm long		20 mm wide x 50 mm long	
Cool down from ambient to 4.2 K	25 min		10 min	
Sample change time	<5 min		60 min	

Creating the Optimum Product for you

Step 1.

Build your Cryostat

Select from the following options to build your specific product order code. Example code shown.

OS-HE-X3-612-100-LV

OS-HE-□-□-□-□

Cryogen	Code
Helium	HE
Sample Environment (Max temp)	**Code**
Sample in exchange gas (300 K)	X3
Sample in exchange gas (500 K)	X5
Sample in Vacuum (500 K)	V5
Transfer Line	**Code**
LLT600 90° 1.2 m flex – Manual	612
LLT650 90° 1.2 m flex – Automated	652
LLT700 180° 1.2 m flex – Manual	712
LLT750 180° 1.2 m flex – Automated	752
Wiring	**Code**
10 DC wires (10 pin)	100
10 DC wires + 2 Coax cables	102
10 DC wires + 4 Coax cables*	104
Pump Voltage	**Code**
High voltage – 220/240 V 50 Hz	HV
Low voltage – 110/120 V 60 Hz	LV

*V5 (CF-V) only

Fast-track configurations

OS-HE-X3-612-100-□

4 x Spectrosil WF windows fitted radially

OS-HE-V5-712-100-□

4 x Spectrosil WF windows fitted radially

Step 2.

Add standard controller, please see page 14 for additional controller options.

Description	Order Code
Mercury iTC Controller (Base unit). Inc. 1 x sensor/heater PID control loop	MERC-ITC-000

Steps 3 & 4

Accessories

A full range of accessories suitable for your cryostat are available on page 12.

Window Options

Every cryostat is supplied with 4 x Spectrosil WF windows, fitted radially, and 1 x blank fitted axially. All windows are user changeable. A selection of window materials with varied transmission properties are available. Please see the Windows information on page 16.

Optistat Dry

Shining a new Light on Optical Spectroscopy

Optistat Dry – 3 K Cryofree® cryostat, for a wide range of spectroscopy applications. Ideally suited for UV/VIS, Raman, FTIR, Fluorescence, Photoluminescence, Micro-PL, Terahertz, Microscopy and Electroluminescence.

Features	Benefits
Superb temperature control	✓ Wide sample temperature range from < 3 K to 300 K. ✓ Low vibration when used in conjunction with the supplied stand, typically less than 10 µm RMS.
Superb optical access	✓ Optimised optical access with f/1 in radial directions allows a large illumination area for measurements involving the detection of low intensity light. ✓ Large sample space enables studies of samples with a wide range of different geometries and sizes. ✓ Adjustable system height to align with experimental optics. ✓ No need to realign the optics after each sample change.
Versatile	✓ Water and air-cooled compressors available.•[2] ✓ Compatible with all optical benches: the optional support stand has feet matching both imperial and metric fixings.
Simple to use	✓ No liquid cryogen required. ✓ Easy sample loading via load port (BLV) or sample tube (TLEX). ✓ Quick and easy to change windows in your laboratory to suit different wavelengths. ✓ Easy electrical connections to your samples. ✓ Upgradeable, flexible wiring options.

Specifications	Dry-TLEX	Dry-BLV
Sample environment	Exchange gas	Vacuum
Temperature range	< 4 – 300 K•[3]	< 3 – 300 K•[3]
Temperature stability (period)	+/-0.1 K (measured over 10 mins)	
Maximum sample space	20 mm diameter	40 mm dia x 50 mm tall
Cold head cooling power	0.2 W at 4.2 K (60 Hz) 0.16 W at 4.2 K (50 Hz)	
Cool down from ambient to 4.2 K	6 hrs	2.5 hrs (200) 3.0 hrs (12P)
Sample change time	5 mins (45 mins to base T)	4-5 hrs
Vibration	<10 µm RMS typical	

Creating the Optimum Product for you

Step 1.

Build your Cryostat

Select from the following options to build your specific product order code. Example code shown.

OS-DRY-X3-AC-240-CN

OS - DRY - [ ] - [ ] - [ ] - [ ]

Cryogen	Code
Dry - Cryofree	DRY
Sample Environment (Max temp)	**Code**
TLEX-Top Loading in EXchange gas (300 K)	X3
BLV – Bottom Loading in Vacuum (300 K)	V3
Compressor	**Code**
Water cooled	WC
Air cooled	AC
Wiring	**Code**
24 DC wires (24 pin Fischer)*	240
20 DC wires (D-connector)**	200
12 DC wires (PCB style puck)**	12P
Voltage	**Code**
240 V, 50 Hz (UK/EU)	UK
208 V, 60 Hz (US)	US
200 V, 50 Hz (CN)	CN

*X models only (standard), **V models only

Step 2.

The Optistat Dry product is supplied with a fully configured MercuryiTC temperature controller as part of the cryostat package. This is configured to monitor cryo-cooler stages and monitor/control temperature at the heat exchanger (BLV) or heat exchanger and sample rod (TLEX). No additional configuration codes are required.

Steps 3 & 4

Accessories

A full range of accessories suitable for your cryostat are available on page 12.

Window Options

Every cryostat is supplied with 4 x Spectrosil WF windows, fitted radially, and 1 x blank fitted axially. All windows are user changeable. A selection of window materials with varied transmission properties are available. Please see the Windows information on page 16.

Sample Holders & Accessories

	DN	
Sample Holders - Description	**DN-X**	**DN-V**
Sample rod	●	⊘
Reflection sample holder	●	●
Transmission sample holder (with aperture)	●	●
Cuvette holder for sample rod	●	⊘
Height adjust and rotate sample rod	○	⊘
Precision height adjust and rotate sample rod	○	⊘
Vacuum 45° reflection sample holder	⊘	⊘
Vacuum 90° reflection sample holder	⊘	⊘
Cu blade with 12 sprung pins	⊘	⊘
Reflection sample puck	⊘	⊘
Transmission sample puck	⊘	⊘
Fused silica cuvette	○	⊘
Accessories - Description		
Turbo station (turbo pump)	○	○
40 m^3 rotary pump (all He options)	⊘	⊘
Nitrogen sidearm (nsa)	⊘	⊘
Rectangular tail	⊘	⊘

● Provided as standard, ○ Optional order, ⊘ Not available

Optistat			
CF		Dry	
CF-X	CF-V	TLEX	BLV
●	⊘	●	⊘
●	●	●	● (200)
●	●	●	● (200)
○	⊘	⊘	⊘
○	⊘	○	⊘
○	⊘	⊘	⊘
⊘	⊘	⊘	○ (200)
⊘	⊘	⊘	○ (200)
⊘	⊘	⊘	● (12P)
⊘	⊘	⊘	● (12P)
⊘	⊘	⊘	● (12P)
○	⊘	⊘	⊘
○	○	○	○
○	○	⊘	⊘
○	○	⊘	⊘
⊘	○	⊘	⊘

Controller Options

Our systems are supplied with a MercuryiTC temperature controller with one sensor/heater PID loop as standard. Additional options are available to order.

Features

- ✓ Supports all standard cryogenic sensors (ruthenium oxide, cernox, silicon diodes, platinum, thermocouple and RhFe).
- ✓ Heater output up to 80 W per channel.
- ✓ Configurable constant voltage or constant current excitation.

Expandable

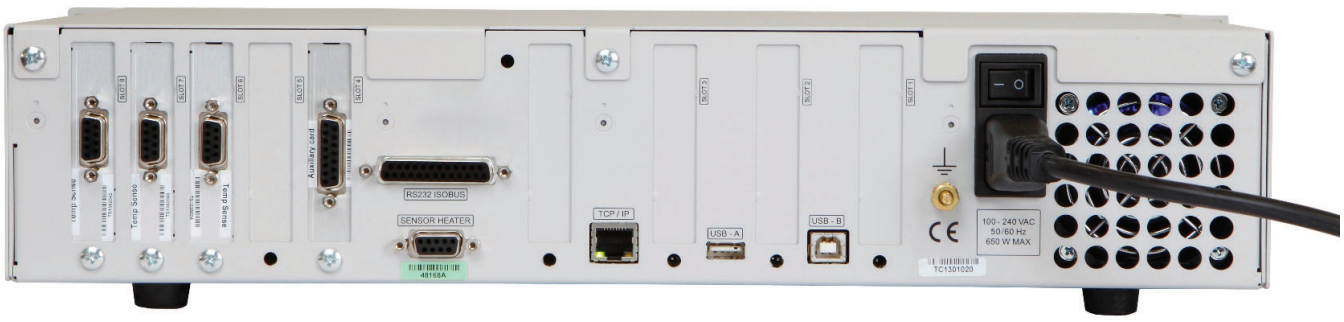
Customisation is possible through the addition of plug and play expansion cards. The controller features 9 expansion slots (8 multi-function slots and a dedicated GPIB slot) which can be used to extend its capability

Expansion cards include additional temperature sensor inputs and heater outputs, pressure transducer inputs, stepper motor drive allowing gas flow regulation and efficient use of liquid helium in flow cryostats and cryogen level metering of both helium and nitrogen.

System control

The intuitive touch screen user interface facilitates easy monitoring, control and configuration of your experimental system.

- ✓ Easy connection to your Mercury instrument via multiple remote interfaces: Ethernet, GPIB, serial or USB.
- ✓ Easy integration within your data acquisition programs and direct and remote control of the cryogenic and superconducting magnet system.
- ✓ Consistent rear panel connections for easy system upgrades.



Ordering

Description	Order Code
Mercury iTC Controller (Base unit). Inc. 1 x sensor/heater PID control loop	**MERC-ITC-000**
Controller + GPIB Card	**MERC-ITC-00G**
Controller + Additional Heater Card	**MERC-ITC-00H**
Controller + Additional Sensor Card	**MERC-ITC-00S**
Controller + GPIB/Sensor cards	**MERC-ITC-0GS**
Controller + Heater/GPIB cards	**MERC-ITC-0HG**
Controller + Heater/Sensor cards	**MERC-ITC-0HS**
Controller + Heater/Sensor/GPIB cards	**MERC-ITC-HGS**

Power Supply Requirements:

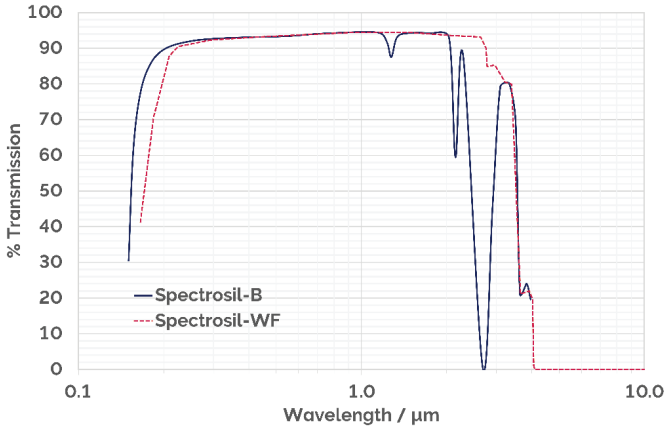
Mercury Temperature Controller iTC power supply	
Mains supply voltage	100 to 240 VAC
Mains supply frequency	50 to 60 Hz
Maximum supply power	650 W
Maximum supply power	+/- 10% of nominal voltage
Gas Flow Pump Helium and Nitrogen Flow Cryostats:	
Mains supply voltage	120 to 240 VAC
Mains supply frequency	50 to 60 Hz
Max power consumption	370 W

Compressors (Optistat Dry only)			
Type	**Frequency**	**1-phase electrical power**	**Power required**
Air cooled	50 Hz	200 V ~ (±5%) 220 V ~ (±5%) 230 / 240 V ~ (±5%)	3.0 kW 15.5 A full load at ~200 V. 60 A starting current. 73 A locked-rotor current.
	60 Hz	220 / 240 V ~ (±10%)	3.4 kW 16.0 A full load at ~220 V. 60 A starting current. 73 A locked-rotor current.
Water cooled	50 Hz	200 V ~ (±5%) 220 V ~ (±5%) 230 / 240 V ~ (±5%)	2.6 kW 13.0 A full load at ~200 V. 58 A starting current. 68 A locked-rotor current.
	60 Hz	208 / 240 V ~ (±5%)	3.0 kW 15.5 A full load at ~200 V. 58 A starting current. 68 A locked-rotor current.

Windows

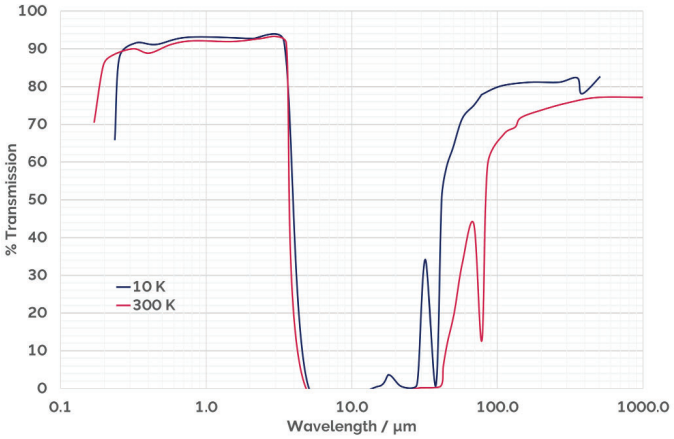
Spectrosil B & WF

Spectrosil B is a synthetic vitreous silica. The material itself is not birefringent and standard strain-relieved low temperature window mounts ensure that Spectrosil B windows do not affect polarised light. It is an excellent material for filtering out the near-mid IR room temperature thermal radiation, resulting in a low thermal load on the cryostat. Spectrosil WF is a water free synthetic vitreous silica, its transmission range extends further into the IR. Data is for a 2 mm thick window.



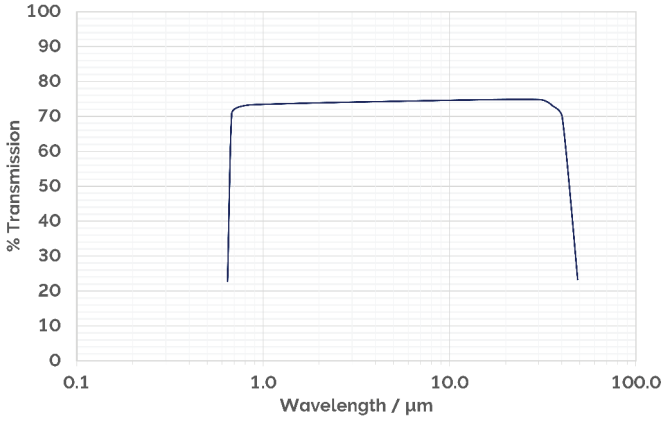
Crystalline Quartz

Crystalline quartz is a window for the visible and near IR. It exhibits a strong temperature dependence in the far IR. At temperatures below 80 K the transmission is greater than 70% for wavelengths above 80 µm. This material may be used as a cold inner window for far IR applications. Crystalline quartz is birefringent and is available cut with the z-axis normal to the window to reduce polarisation effects. The transmission data is for a 2 mm thick window.



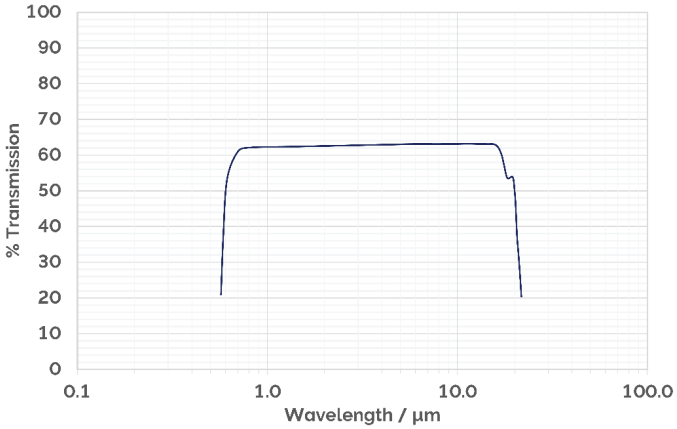
KRS-5

KRS-5 (Thallium Bromide-Thallium Iodide) is a useful window for the mid IR. The complex nature of the cold window mount and the necessity to make it vacuum tight results in the clear access diameter being reduced by 2 mm when compared with other materials. The material is toxic and should be handled with care.



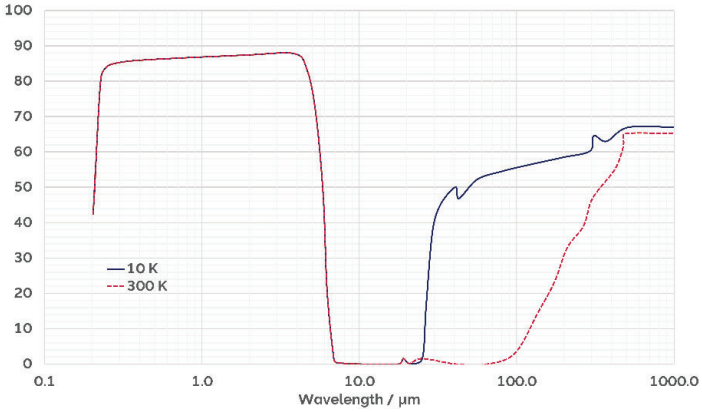
Zinc Selenide

Zinc selenide is a reliable cryogenic window for the mid IR. Care should be taken with handling as it is toxic and scratches easily. The transmission data is for a 2 mm thick window.



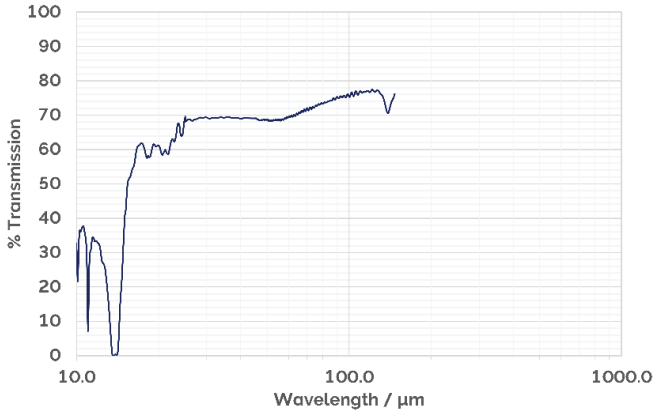
Sapphire

Sapphire is an alternative window for visible and near IR applications. It is the only window which may be used at high temperatures (up to 500 K). At temperatures below 80 K the transmission of sapphire increases in the extreme IR region. This effect allows sapphire to be used as a cold inner window for IR measurements. Sapphire is birefringent. The transmission data is for a 2 mm thick window.



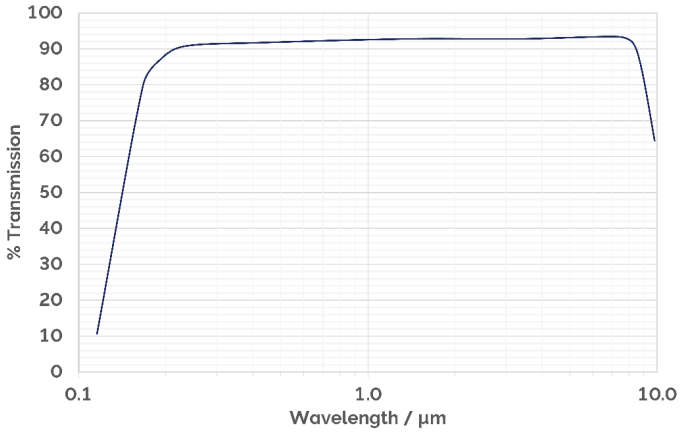
Polythene

Polythene is a polymer which may be used in the extreme IR. The material is porous to helium gas above 100 K. The transmission data is for a 1 mm thick window.



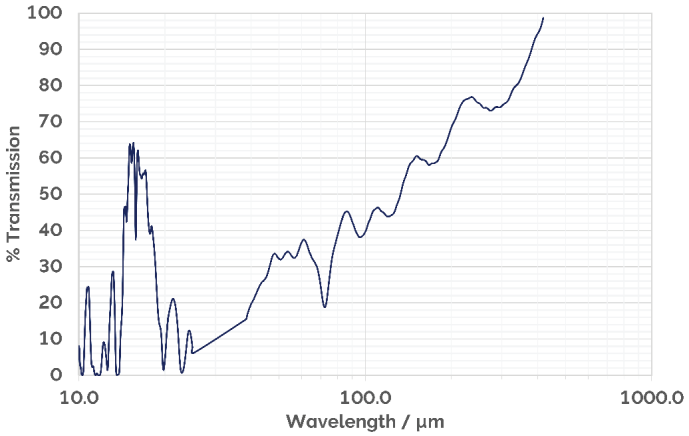
Calcium Fluoride

Calcium fluoride may be used in the near and mid IR. It cannot be used as a cold inner window due to its mechanical and thermal properties. The transmission data is for a 2 mm thick window.



Mylar™

Mylar™ is a polyester film. Standard windows are 125 µm thick and may be used as a cryogenic window in the extreme IR. Mylar is porous to helium gas above 100 K.



Windows

Description	DN-X Outer/Inner	D
Spectrosil WF	●/●	
Spectrosil B	○/○	
Sapphire	○/○	
High temperature sapphire window with Cu gasket (external) and Spectrosil B (internal)	⦸/○	
Crystalline quartz	○/○	
Calcium fluoride	○/⦸	
KRS-5	○/⦸	
Zinc selenide	○/○	
Polythene	○/⦸	
Blanks	○/○	

● **Provided as standard,** ○ **Optional order,** ⦸ **Not available**

Mylar & Aluminised Mylar, Diamond, Beryllium and other windows are available through our Customer Special Request process, Please ask your NanoScience sales representative for information.

Optistat				
N	CF		Dry	
DN-V Outer	CF-X Outer/Middle/ Inner	CF-V Outer/Middle	TLEX Outer/Middle/ Inner	BLV Outer
●	●/●/●	●/●	●/●/●	●
○	○/○/○	○/○	○/○/○	○
○	○/○/○	○/○	○/○/○	○
NA	⊘/⊘/○	NA	NA	NA
○	○/○/○	○/○	○/○/○	○
○	○/○/⊘	○/○	○/○/⊘	○
○	○/○/⊘	○/○	○/○/⊘	○
○	○/○/○	○/○	○/○/○	○
○	○/○/⊘	○/○	○/○/⊘	○
○	○/○/○	○/○	○/○/○	○

Order Today

Need more information? At NanoScience we are committed to finding the correct solution for you. With a dedicated team of technical advisors, we are able to offer you one-to-one guidance and technical support on all NanoScience products.

For a full listing of our local sales offices, please see:

www.qd-oxford.com/services/sales

Quantum Design
OXFORD

Quantum Design Oxford
Tubney Woods, Abingdon
Oxfordshire, OX13 5QX
United Kingdom

www.qd-oxford.com
info@qd-oxford.com

+44 1865 393200

OPTSS 0624 R2