

# Microstats

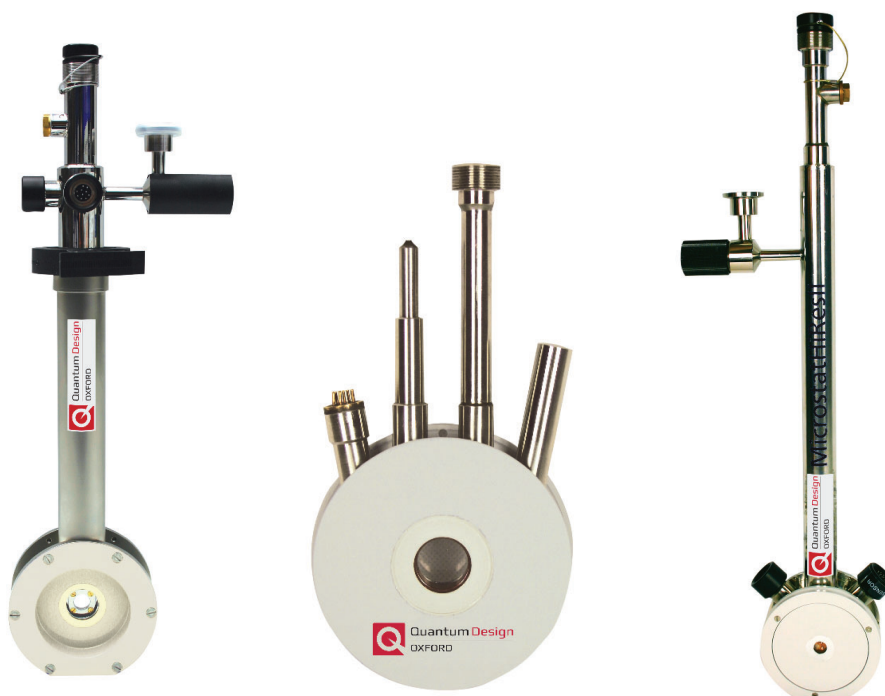
## Automated & Compact Optical Cryostats for Microscopy

### Key Features

- ✓ Excellent temperature control
- ✓ Fully automated control
- ✓ Fast cooldown times
- ✓ User exchangeable window options
- ✓ Wide temperature ranges
- ✓ Most economic running costs

### Key Applications

- ✓ Micro-FTIR
- ✓ Micro-Raman
- ✓ Micro-luminescence
- ✓ Micro-photoluminescence
- ✓ Fluorescence Spectroscopy
- ✓ Ultraviolet-Visible Spectroscopy



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# Introducing our Microstat Range

Our easy to use, compact and efficient Microstat 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 Microstat model of choice will depend on the base temperature, available cryogen and level of stability required for your experiments.

## The Microstat 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.

An extensive range of interchangeable window flanges 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.





	Microstat Model		
	N	He	HiRes
Cooling medium	Liquid nitrogen	Liquid helium or liquid nitrogen	Liquid helium or liquid nitrogen
Temperature range	77.2 - 500 K	2.2 - 500 K	2.7 - 500 K
Temperature stability	> 0.5 K	± 0.1 K	± 0.1 K
Cooldown time	< 10 min	< 10 min	< 15 min
Sample space diameter x height (mm)	20 x 2	20 x 5	20 x 5
Working distance (mm)	2	4.5 to 5.5 8 for rectangular tail	2.2 to 5.7
Vibration (vertical)	< 0.1 µm	< 0.1 µm	< 20 nm
Lateral sample holder drift at constant temperature	< 1 µm / hour	< 1 µm / hour	150 nm / hour
Cryogenic consumption (L/hr) at 4.2 K for helium at 80 K for nitrogen	< 0.5 (nitrogen)	< 0.45 (helium)	< 0.7 (helium)

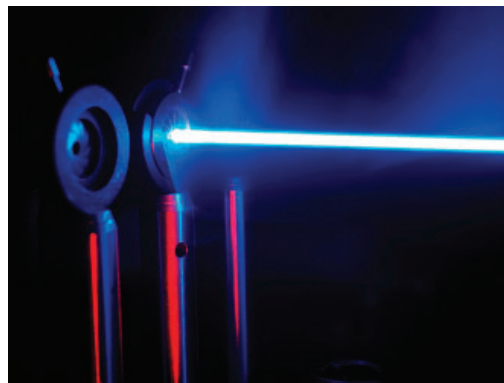
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# Application Focus

## Ultraviolet–Visible Spectroscopy

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



## Micro-Raman

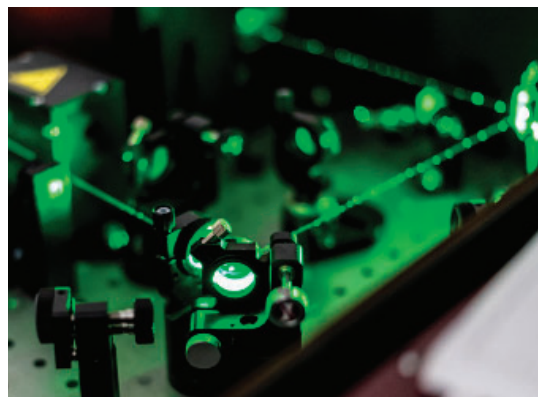
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The Microstat range of cryostats allows for Raman spectra to be recorded using microscopy objectives in a temperature-controlled sample-in-vacuum environment. Windows, both top and bottom, allow for reflection and transmission measurements.

## Micro-FTIR

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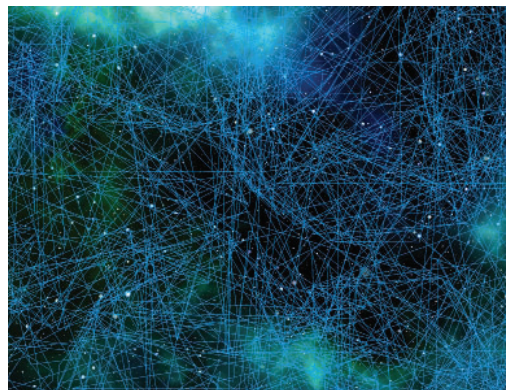
FTIR spectroscopy, widely used for polymer research, inorganic chemistry, pharmaceutical or drug related research, as well as solid state and semiconductor physics. The integration of the Microstat range of cryostats can allow for spectral mapping of samples across a wide range of temperatures, giving localized information about your samples. Window flanges are available to span the near to extreme IR.



## Magneto-Optical Kerr Effect

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Magneto-Optical Kerr Effect (MOKE) can be used to investigate the magnetization structure of materials. Using the Microstat He coupled with a narrow rectangular tail-set, samples can be inserted between the poles of an electromagnet while maintaining optical access to the sample.



## Micro-photoluminescence

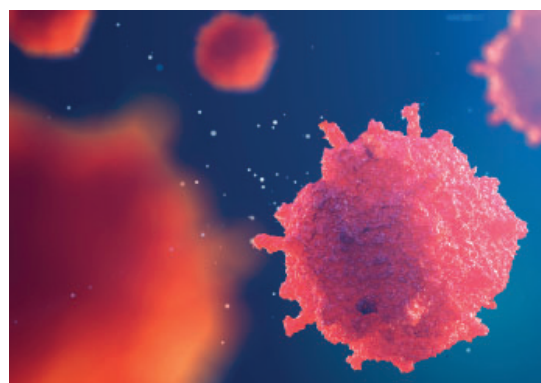
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Micro-photoluminescence or Micro-PL spectroscopy is a powerful tool for investigating the optical and electronic properties of single nanostructures. The Microstat range of cryostats allows for mapping of semiconductor microstructures with sub-micron spatial resolution and single photon counting across a wide range of temperatures.

## Fluorescence Spectroscopy

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The Microstat range of cryostats can be applied to microscopy samples using Fluorescence spectroscopy. Cryostats using liquid nitrogen or liquid helium offer temperature control to below 4 K with minimal distance between sample and objective.



# Microstat N

## Lowest Nitrogen Consumption on the Market

This liquid nitrogen cryostat is designed for experiments requiring temperatures down to 77 K. It is compact and lightweight and requires only a small nitrogen container ensuring the system is convenient to use where space is limited.

Features	Benefits
<b>Superb temperature control</b>	<ul style="list-style-type: none"><li>✓ Wide temperature range: from 77.2 K to 500 K.</li><li>✓ Economical use of nitrogen: less than 0.5 L/hr (nominal) at 77 K.</li></ul>
<b>Fast cooldown</b>	<ul style="list-style-type: none"><li>✓ 80 K in less than 10 minutes.</li></ul>
<b>Superb optical &amp; sample access</b>	<ul style="list-style-type: none"><li>✓ Adjustable sample holders accommodate samples up to 8 mm thick.</li><li>✓ Suitable for reflection and transmission experiments via choice of sample holders.</li></ul>
<b>Compact</b>	<ul style="list-style-type: none"><li>✓ Extremely compact: 90 mm diameter by 24 mm thickness. Only 400 g.</li></ul>
<b>Great connectivity</b>	<ul style="list-style-type: none"><li>✓ Easy integration into commercial microscopes facilitated by its compact size and short working distance of 2 mm. Interface plate available as option for attaching the Microstat N directly onto microscope translation stage.</li><li>✓ Electrical measurements via 4-pin DC wiring loom to the heat exchanger sample position.</li></ul>

Specifications	Microstat N	
	0.5 mm	1.5 mm
Window thickness		
Clear access diameter	10 mm	25 mm
Working distance to sample holder	1 mm (min)	2 mm (min)
Angle of admittance (to surface of sample holder at centre)	126°	160°
Max sample thickness at highest sample position	2 mm	1 mm
Max sample diameter	20 mm	

## Creating the Optimum Product for you

### Step 1.

#### Build your Microstat

Order code for the Microstat N

MS-LN-V5-400-040-



#### Fast-track configurations

MS-LN-V5-400-040-

MS- - - - -

Cryogen	Code
Liquid Nitrogen	LN
Sample Environment (Max temp)	Code
Sample in Vacuum (500 K)	V5
Transfer Line	Code
Vacuum insulated LN <sub>2</sub> transfer line	400
Wiring	Code
4 DC wires to sample position	040
Pump Voltage	Code
High voltage – 220/240 V 50 Hz	HV
Low voltage – 110/120 V 60 Hz	LV

\* HR only † He models only

### Step 2.

Add standard controller, please see [page 10](#) for additional controller options.

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

### Step 3 & 4

#### Accessories

A full range of accessories suitable for your cryostat are available on [page 12](#).

#### Window Options

Each cryostat is supplied with Spectrosil WF window flanges top and bottom as standard. All flanges are user changeable and a selection of additional window materials with a variety of transmission properties are available. Please see the Windows information on [page 12](#).



# Microstat He & HiRes

## Lowest Helium Consumption and Fastest Cooldown on the Market

This helium flow cryostat has been designed as a flexible 4 K platform for use in conjunction with short working distance microscope objectives. Available as a cold finger cryostat or with a concentric heat exchanger for low vibration, excellent spatial resolution and minimal sample drift.

Features	Benefits
<b>Superb temperature control</b>	<ul style="list-style-type: none"><li>✓ Wide temperature range: 2.2 K to 500 K.</li><li>✓ Rapid cooldown time: 4.2 K in less than 10 minutes!</li><li>✓ Economical use of cryogens: the lowest consumption on the market from only 0.45 l/hr at 4.2 K.</li><li>✓ Can be used with liquid nitrogen.</li></ul>
<b>Great connectivity</b>	<ul style="list-style-type: none"><li>✓ Electrical measurements via 10-pin electrical feed wires, or optional miniature coax cables, to pins adjacent to the sample position.</li></ul>
<b>Versatile</b>	<ul style="list-style-type: none"><li>✓ Easy integration into commercial microscopes facilitated by its compact size and short working distance of 2 mm. Interface plate available as option for attaching the MicrostatHe directly onto microscope.</li><li>✓ Suitable for reflection and transmission experiments.</li><li>✓ 3 in 1 flexible design with easily interchangeable tail between the Optistat CF-X, Microstat He and Microstat He Rectangular tail.</li></ul>

Specifications	He		HiRes	
	0.5 mm	1.5 mm	0.5 mm	1.5 mm
Window thickness				
Clear access diameter	10 mm	25 mm	10 mm	25 mm
Working distance to sample holder	3.0 - 4.5 mm	3.0 - 5.5 mm	2.2 - 5.7 mm	3.2 - 6.7 mm
Angle of admittance (to surface of sample holder at centre)	102°	144°	142°	166°
Max sample thickness	5 mm		5 mm	
Max sample diameter	20 mm	20 mm	20 mm	20 mm



## 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.

MS-HE-V5-612-100-LV



#### Fast-track configurations

MS-HE-V5-612-100-

MS- - - - -

Cryogen	Code
Helium (He)	HE
Helium, high resolution, low vibration (HiRes)	HR
Sample Environment	Code
Sample in vacuum	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 + 1 Coax cables*	101
10 DC wires + 2 Coax cables <sup>†</sup>	102
10 DC wires + 4 Coax cables <sup>†</sup>	104
Pump Voltage	Code
High voltage – 220/240 V 50 Hz	HV
Low voltage – 110/120 V 60 Hz	LV

\* HR only <sup>†</sup> He models only

### Step 2.

Add standard controller, please see [page 10](#) for additional controller options.

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

### Step 3 & 4

#### Accessories

A full range of accessories suitable for your cryostat are available on [page 12](#).

#### Window Options

Each cryostat is supplied with Spectrosil WF window flanges top and bottom as standard. All flanges are user changeable and a selection of additional window materials with a variety of transmission properties are available. Please see the Windows information on [page 12](#).

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# 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.



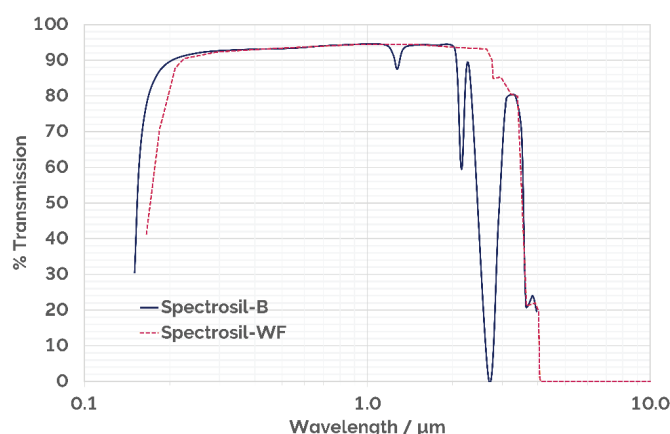
## Ordering

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

# Windows

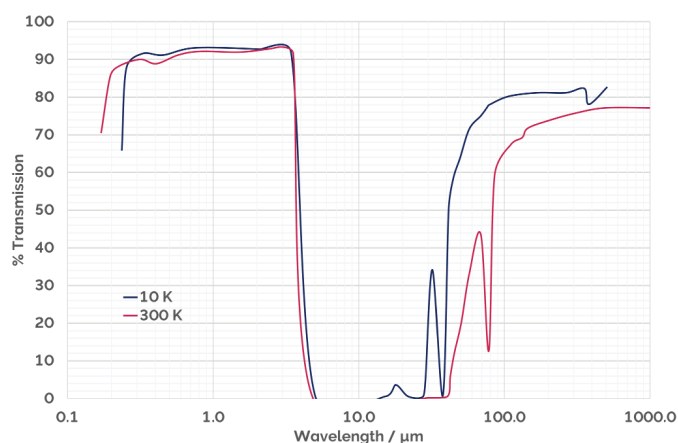
## Spectrosil B & WF

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.



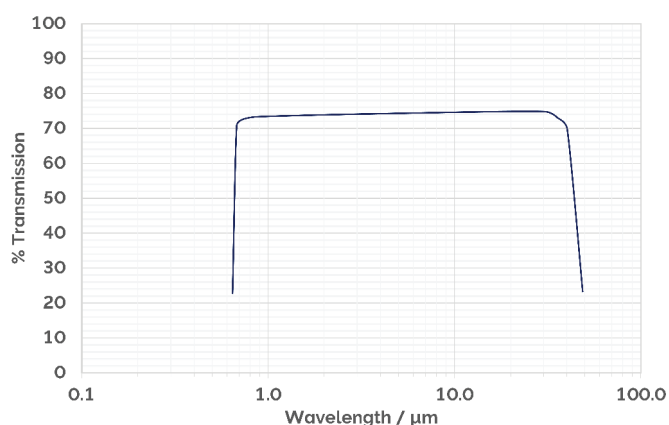
## Crystalline Quartz

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  $\mu\text{m}$ . 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.



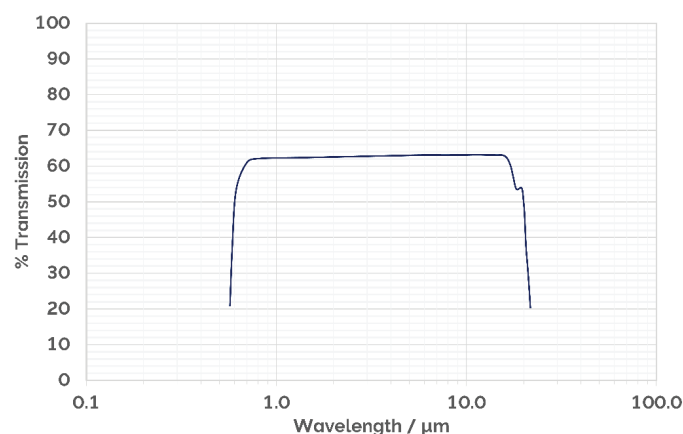
## KRS-5

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.



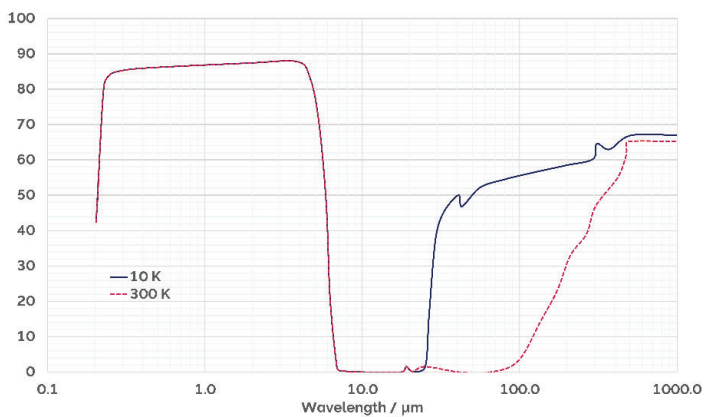
## Zinc Selenide

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.



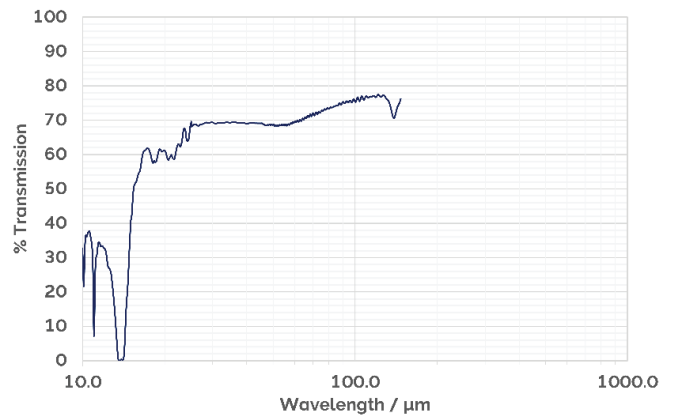
## Sapphire

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.



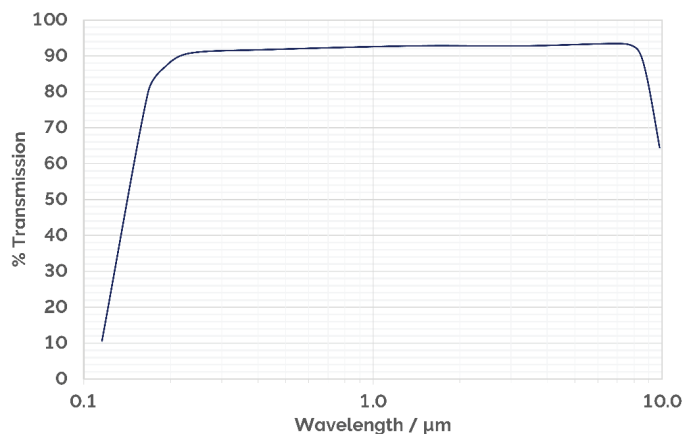
## Polythene

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.



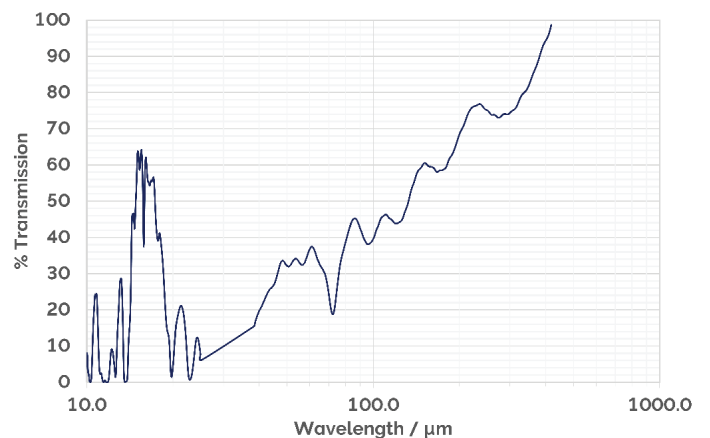
## Calcium Fluoride

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  $\mu\text{m}$  thick and may be used as a cryogenic window in the extreme IR. Mylar is porous to helium gas above 100 K.



# Windows

	Microstat		
	N	He	HiRes
Description			
Spectrosil WF	●	●	●
Spectrosil B	○	○	○
Sapphire	○	○	○
Calcium fluoride	○	⊘	○
KRS-5	○	○	○
Zinc selenide	○	○	○

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

Diamond, Beryllium and other windows may be available through our Customer Special Request process, Please ask your NanoScience sales representative for information. "Film" windows, such as Mylar are not currently available for Microstat windows due to the adhesive process and deformation due to pressure differential.

# Accessories

	Microstat		
	N	He	HiRes
Description			
Turbo station (turbo pump)	○	○	○
40 m <sup>3</sup> rotary pump (all He options)	⊘	○	○
Nitrogen sidearm (nsa)	⊘	○	○
Rectangular tail	⊘	○	⊘
Optistat CF-V tail kit	⊘	○	⊘
Pillar upgrade kit (for magnet experiments).	⊘	⊘	○
Cryostat mounting plates	○	○	○

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

## 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



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