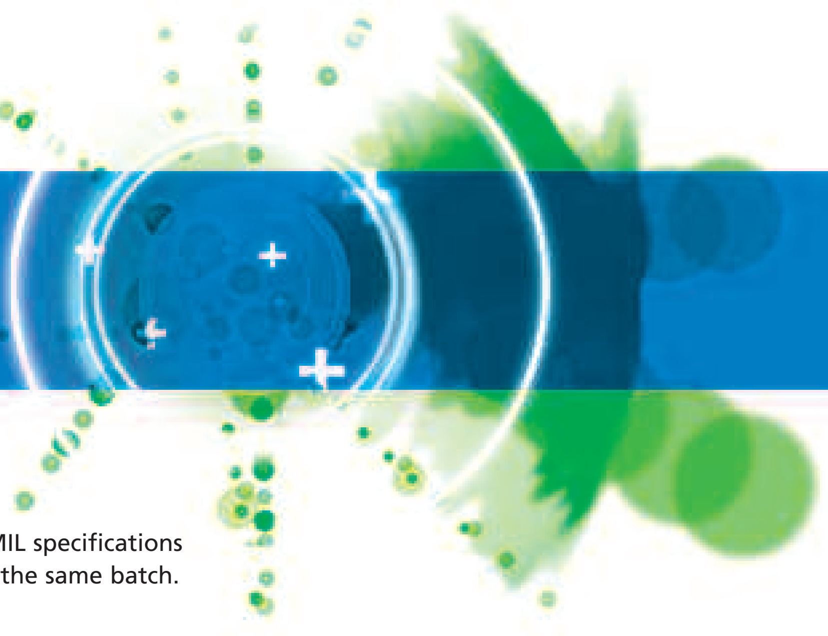
Environmental Testing capabilities



All tests, where applicable, are carried out per MIL specifications
and on a representative witness piece coated in the same batch.

STATIC HUMIDITY TEST

A standard test typically performed over 24 hours in 98% Relative Humidity at 49°C. This can be varied for customer specific requests. For Hard Carbon coatings and STAR coatings, this test would be performed for 7 and 10 days respectively.

CYCLING HUMIDITY TEST

This test is performed only by specific request from a customer.
Typically performed at 98% Relative Humidity between 35°C and 65°C.
This test can be performed at other temperatures and Relative Humidity by request.

WATER IMMERSION TEST

A standard test typically performed over 24 hours.

SALT SOLUTION TEST

A standard test typically performed over 24 hours.
By customer request this can be extended up to 7 days.

SALT SPRAY (FOG) TEST

This test is typically performed over 24 hours at 47°C.
By customer request this can be extended up to 90 days.

TEMPERATURE TEST

A standard test which cycles between hot and cold temperatures, typically between -62°C and +71°C for 5 hours each.
The temperature and duration can be varied to customer's specific requirements.
We also have the capability to perform Thermal Shock Tests upon request.

ABRASION TEST

A standard test varying from Moderate Abrasion with cheesecloth to Severe Abrasion with an eraser at a known pressure. Other Abrasion tests that can be carried out include Sand Abrasion and Windscreen Wiper Abrasion.

ADHESION TEST

A standard test performed using adhesive tape to a known specification.

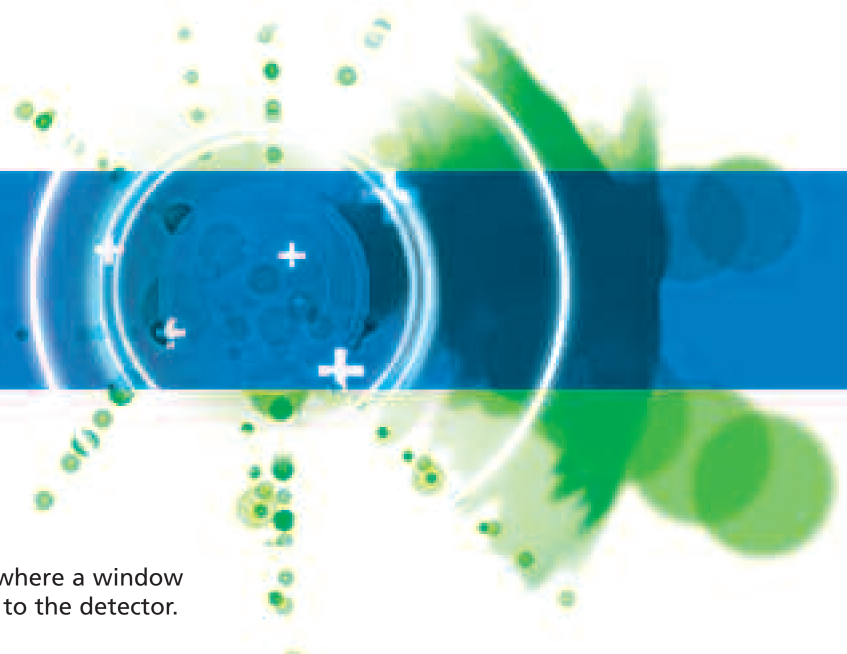
SOLUBILITY & CLEANABILITY TEST

This test is performed only by specific request from a customer.
Typical chemicals used would be Acetone, IPA or AG101.

CHEMICAL DEGRADATION TEST

This test is performed only by specific request from a customer.
A coated witness sample would be subjected to chemical attack using customer specified chemicals.

11/12/2007 Issue 03

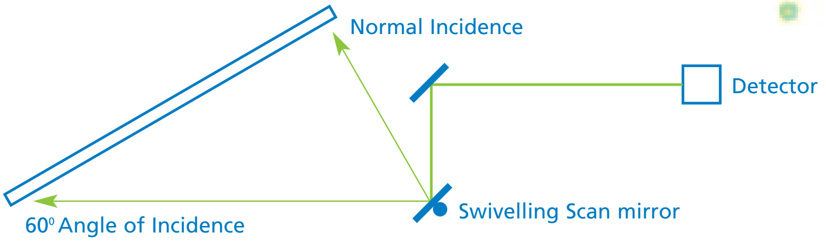


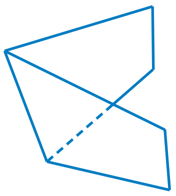
Graded Coatings

Low reflectivity coating

DESCRIPTION

Graded coatings can be useful in applications where a window subtends an apparent range of angles relative to the detector.

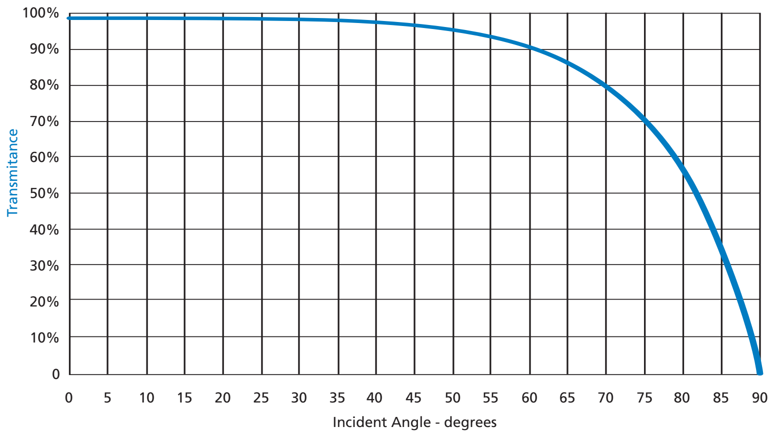




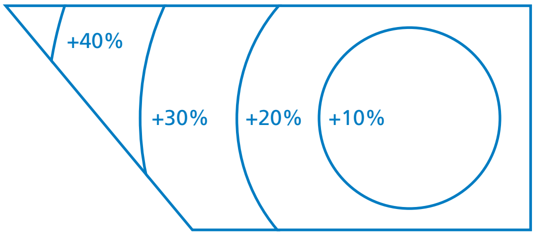
Chisel-nosed optic

An example of this is found in chisel-nose optical assemblies.

The performance of optical coatings moves to shorter wavelengths with increased angle of incidence. This effect can be quite pronounced at angles greater than 45 degrees.

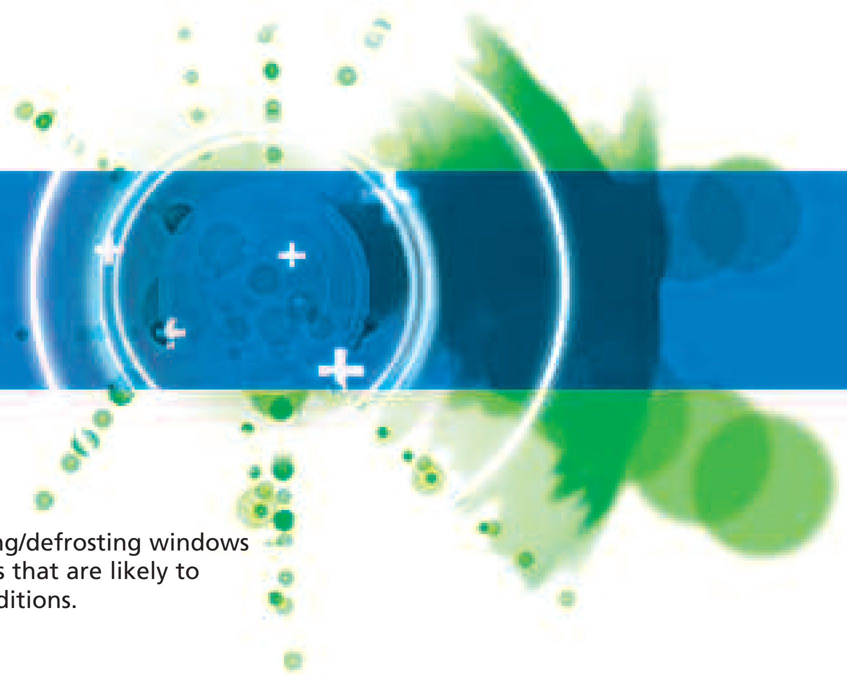


To correct for this shift in performance, within certain constraints, the coating can be made thicker where the angle of incidence of the light on the window is greatest. This improves the operational uniformity and efficiency of the window.



Relative coating thickness.

Heading / De-Frosting & EMC Shielding windows



CVI Melles Griot has the capability to offer de-misting/defrosting windows by means of heating. This is typically used in systems that are likely to encounter variances in temperature or weather conditions.

There are two different ways of heating a window:

DIRECT

By using the bulk resistivity of Semiconductor materials such as Germanium and Silicon, a current can be passed directly through the material by means of busbar technology. Busbars can be manufactured to fit most thicknesses of window.

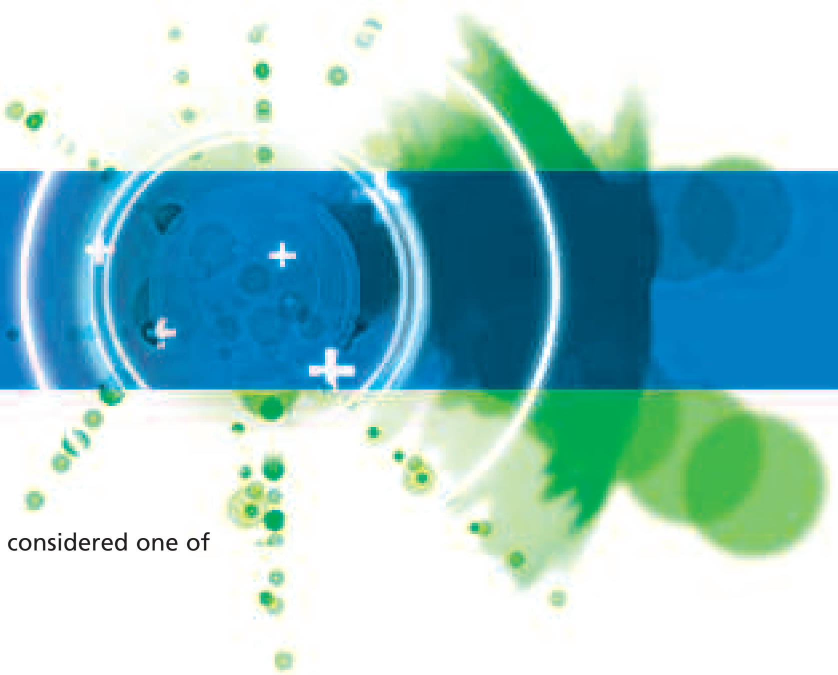
INDIRECT

Indirect heating is suitable for use where non-conducting materials are required in a system such as Zinc Sulphide. Heating can be achieved using insulated foil heaters. Foil heaters can be manufactured to a minimum width of approx. 6 mm.

POWER REQUIREMENTS

It is best to consider requirements for a system at an early stage. This way, CVI Melles Griot can offer advice on the power required and the best method for delivering heat into a window. Options to consider would be whether a current limiter or temperature control are required. Current/Voltage combinations should also be considered.

As each individual system has different requirements, we would recommend discussing your requirements with us prior to finalizing design.



CNC Twin Lapping Capabilities

High Speed Lapping and Polishing Capability

Lapping and Polishing of plano / plano optics is considered one of our core competencies.

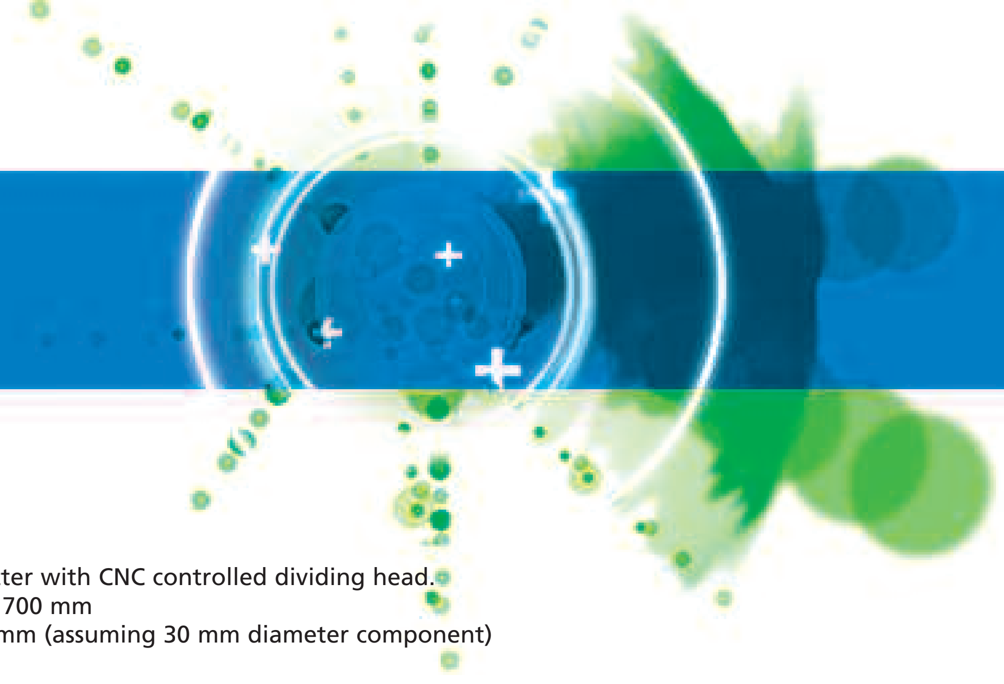
MATERIALS WORKED INCLUDE

Germanium,
Silicon,
Zinc Sulphide (including Multi-spectral),
Zinc Selenide,
BK7,
Fused Silica,
Filter Glass.

TYPICAL WINDOW SPECIFICATIONS ACHIEVABLE

Parallelism: < 5 arc Seconds
Transmitted Wave Front: 0.03 λ @ 10.6 µm – 0.5λ @ 633 nm
Flatness: < 5 fringes / 1 Irregularity
Standard Diameters: from 25 mm up to 300 mm
Standard Thickness: from 2 mm up to 55 mm

Diamond Machining



SPECIFICATION

4 CNC controlled lathes. 1 fly-cutter with CNC controlled dividing head.
Maximum component diameter: 700 mm
Maximum off axis distance: 335 mm (assuming 30 mm diameter component)
Typical surface form: λ / 2
Typical surface finish: 5 nm

MATERIALS

Germanium, Silicon, ZnSe, ZnS, Amtir, IG 1-6, acrylic, PMMA, polycarbonate
Aluminium, copper (OFHC), brass, mouldmax, bronze, electroless-nickel plated substrates.

LENSES

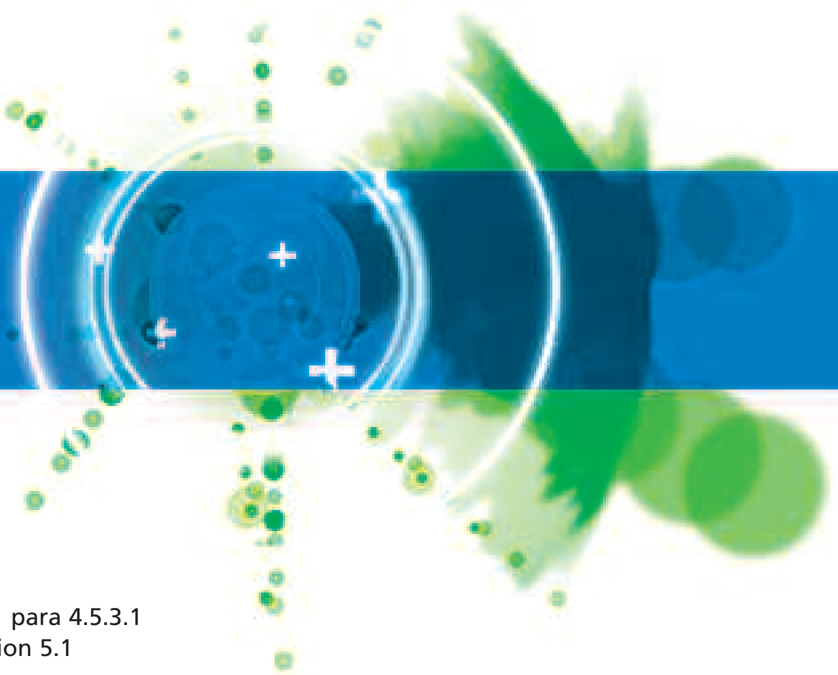
Aspheric, diffractive, multi-focus, domes.

MIRRORS

flat, spherical, parabolic (off and off-axis), elliptical, polygon, cube, slicer

MOULD TOOLS

Contact lens, Fresnel lens



Coating Specifications

Durability and Environmental Test Classification

CLASS 1

1.1 ADHESION	MIL-C-48497 para 4.5.3.1 TS 1888 Section 5.1
1.2 HUMIDITY	MIL-C-48497 para 4.5.3.2 TS 1888 Section 5.2.1.2
1.3 ABRASION (MODERATE)	MIL-C-48497 para 4.5.3.3 TS 1888 Section 5.4.1

NOTES

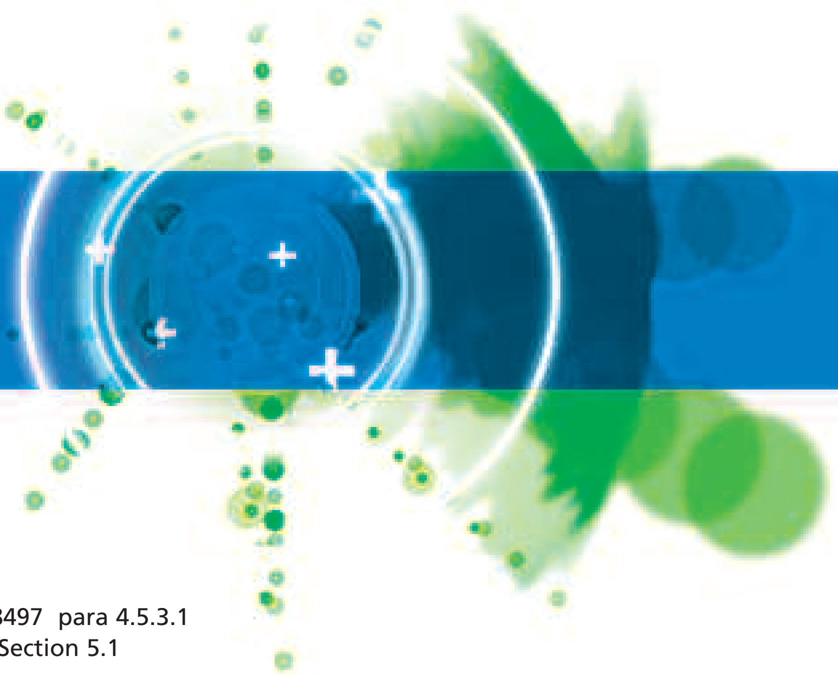
Tests will be carried out sequentially unless otherwise specified.
Tests will be performed on 25 mm diameter witness pieces, nominally 1 mm thick.

CLASS 2

1.1 ADHESION	MIL-C-48497 para 4.5.3.1 TS 1888 Section 5.1
2.2 HUMIDITY	MIL-C-48497 para 4.5.3.2 TS 1888 Section 5.2.1.2
2.3 SALT SOLUBILITY	MIL-C-48497 para 4.5.5.2 TS 1888 Section 5.2.1.1
2.4 ABRASION (SEVERE)	MIL-C-48497 para 4.5.5.1 TS 1888 Section 5.4.2

NOTES

Tests will be carried out sequentially unless otherwise specified.
Tests will be performed on 25 mm diameter witness pieces, norminally 1 mm thick.



Coating Specifications

Durability and Environmental Test Classification

CLASS 3

3.1 ADHESION	MIL-C-48497 para 4.5.3.1 TS 1888 Section 5.1
3.2 SALT FOG	MIL-STD-810C Method 509.1
3.3 HUMIDITY 7 Days	MIL-C-48497 para 4.5.3.2 TS 1888 Section 5.2.1.2
3.4 ABRASION (EXTREME) Windscreen Wiper	TS 1888 Section 5.4.3

NOTES

Tests will be carried out sequentially unless otherwise specified.
Tests will be performed on 25 mm diameter witness pieces, nominally 1 mm thick.

Contrast Enhancement Filters/ Conductive Coatings

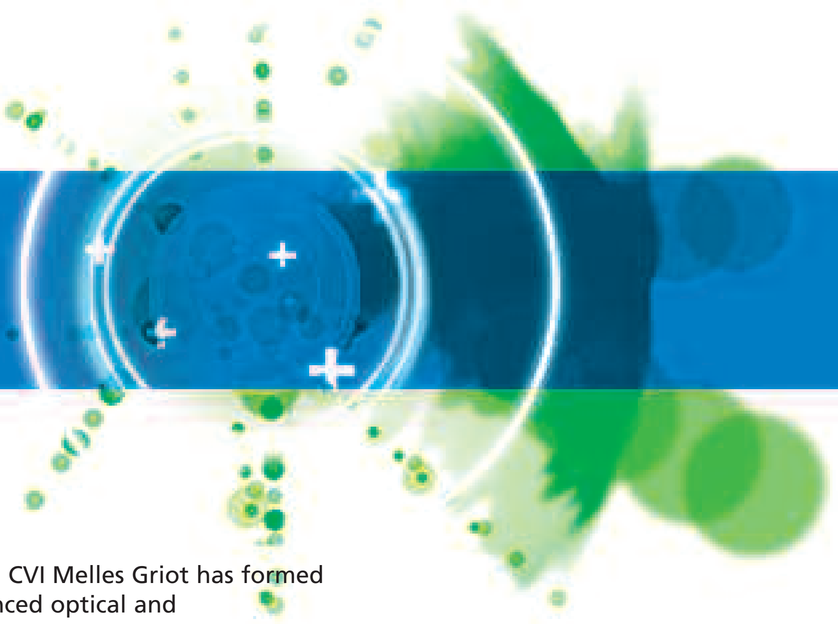
- Complete Design and System Interface
- Precision Optical Manufacture
- CNC profile for complex geometry
- Laminate sub-assembly
- A Suite of Anti-Reflection Coatings
- Busbar application
- Highly durable environmental performance
- NCG compatible interface filters

CVI Melles Griot has developed a complete manufacturing capability for high transmission conductive coated filters for contrast enhancement on instrumentation windows. Flexibility of design and a range of coating types allow an innovative approach to the provision of cost effective manufacturing solutions.

The following data sheets give some examples of available coatings.

CO CC01	Without anti-reflective coating
CO CC02	Including anti-reflective coating
CO CC03	Very low reflectivity conductive coating
CO CC04	Low reflectivity conductive coating
CO BS12	Visible/infra red beamsplitter
CO CC07	Conductive coatings for heating applications.

For information on our full range of capability contact CVI Melles Griot directly.



DATA

Design, Assembly and Test in Association

DESIGN CAPABILITIES

In order to provide a fully integrated capability CVI Melles Griot has formed a partnership with a highly skilled and experienced optical and opto-mechanical design team who undertake the design and development of ultraviolet visible and infrared components and systems. Typically the design teams can undertake initial concept and feasibility studies that can then be used to generate design specifications leading on to detailed optical and opto-mechanical design, prototype and production manufacture.

The design teams utilise a large suite of optical and opto-mechanical modelling software. The optical design team's capability is underpinned by extensive use of the internationally renowned CODE V software, although ZEMAX and in-house developed software packages are also used. The opto-mechanical design team utilise and are fully conversant with all aspects of the most up-to-date CAD/CAM techniques and use both Pro-engineer and AUTOCAD to design current mechanical systems.

ASSEMBLY CAPABILITIES

Our partner has a skilled and multi-disciplined production team who operate within a BS5295 Class K clean room that incorporates both a number of laminar booths providing Class E working environments and specialised rooms providing test facilities for optical and electric/electronic testing of systems. These conditions enable them to undertake both small and large volume precision manufacturing of either 'contract build-to-print' or 'in-house designed' optical components, sub-assemblies and complete systems. Additional external laboratories and darkrooms provide the facilities for assessment and testing of prototype or pre-production systems and investigation of associated experimental test techniques.

IN-HOUSE TESTING CAPABILITIES

All developed and manufactured components; sub-assemblies and complete systems undergo stringent quality performance assessment using a large range of optical and opto-mechanical test equipment. Equipment includes visible and infrared (3-5 & 10.6 microns) interferometers that provide a wide range of results (i.e. form/shape) including MTF using Phase Shifting hardware and software, separate point and line spread function MTF systems, FTIR spectrophotometry, electric and electronic testing equipment, laser and optical alignment systems and many other associated test configuration equipment.

ZINC SELENIDE

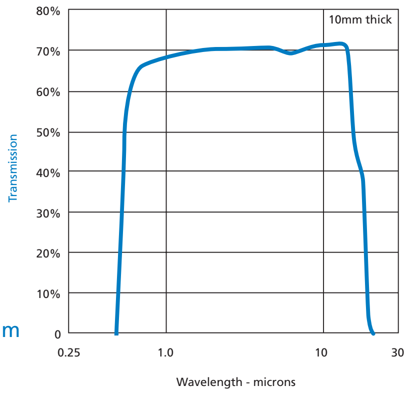
Because of its low absorption at infrared wavelengths, as well as its visible transmission, ZnSe is a preferred material for lenses, windows, output couplers and beam expanders. For high power applications, it is critical that the material bulk absorption and internal defect structure be carefully controlled, that minimum damage polishing technology be employed, and the highest quality optical thin film coatings are used. Il-VI employs a CO2 vacuum calorimeter capable of resolving fractional absorption into the 10^{-4} range to monitor its production processing and to constantly improve finished product performance.
Our Quality Assurance Department will provide testing and certification of specific optics on request.

ZnSe optics are routinely polished at diameters of 6 mm up to 300 mm.
Sizes in excess of 300 mm diameter and 25 mm thick can be manufactured to customer requirements .
ZnSe is non-hygroscopic, chemically stable unless treated with strong acids, and safe to use in the industrial field, as well as laboratory environments.

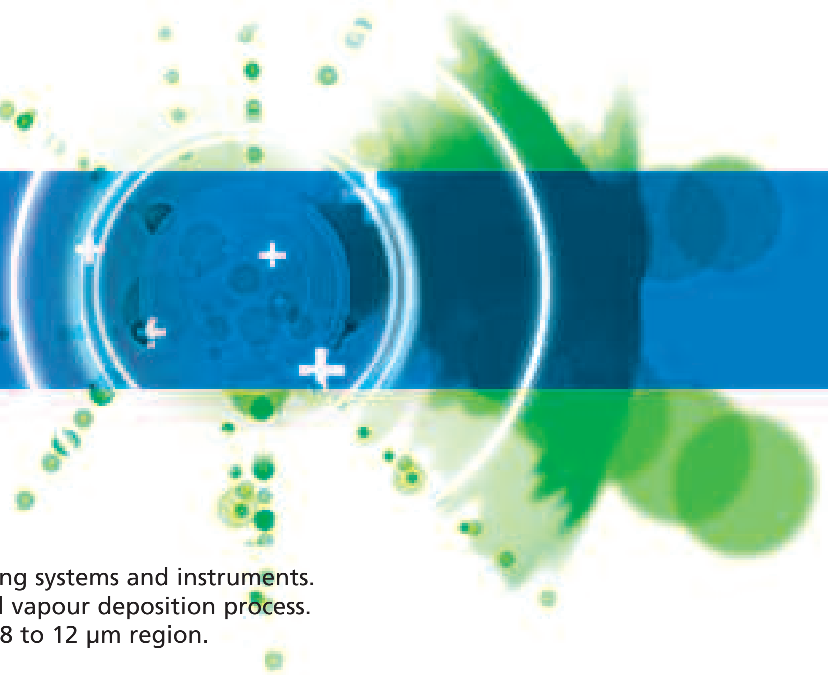
MATERIAL PROPERTIES

OPTICAL PROPERTIES	UNITS	
Bulk Absorption Coefficient @ 10.6 µm	/cm	≤0.0005
Temperature Change of Refractive Index @ 10.6 µ	x 10^{-5}/°C	61
Refractive Index Inhomogeneity @ 632.8 nm		<$3x10^{-5}$
THERMAL PROPERTIES		
Thermal Conductivity	W/cm/°C	0.18
Specific Heat	J/g/°C	0.356
Linear Expansion Coefficient @ 20°C	x10^{-5}/°C	7.57
MECHANICAL PROPERTIES		
Young's Modulus	x10^{11} dyne/cm^2	6.72
Rupture Modulus	x10^8 dyne/cm^2	5.5
Knoop Hardness	Kg/mm^2	105-120
Density	g/cm^3	5.27
Poisson's Ratio		0.28

Multiply dyne/cm^2 x 1.45 x 10^{-5} to give PSI



ZnSe Transmission Spectrum



ZINC SULPHIDE

Two grades of ZnS are available for use in imaging systems and instruments.
Regular grade material is grown by the chemical vapour deposition process.
This material is often used in the 3 to 5 µm and 8 to 12 µm region.
It is available in large sizes as well.

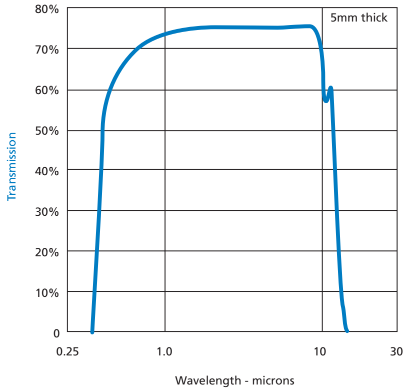
MultiSpectral grade ZnS is treated after growth to eliminate microscopic voids and defects which occur in the Regular grade, thus extending the usefulness of this material to include the visible region.

MATERIAL PROPERTIES

OPTICAL PROPERTIES	UNITS	REGULAR	MULTISPECTRAL
Bulk Absorption @ 10.6 µm	/cm	≤0.24	≤0.20
Temperature Change of Refractive Index @ 10.6 µm	X10^{-5}/ºC	41	
Temperature Change of Refractive Index @ .6328 µm	x10^{-5}/ºC		54
Refractive Index In homogeneity		<100x10^{-6} *	<20x10^{-5} **
THERMAL PROPERTIES			
Thermal Conductivity @ 20ºC	W/cm/ºC	0.167	0.272
Specific Heat	J/g/ºC	0.469	0.527
Linear Expansion Coefficient @ 20ºC	x10^{-5}/ºC	6.8	6.5
MECHANICAL PROPERTIES			
Young's Modulus	x 10^{11} dyne/cm^2	7.45	7.45
Rupture Modulus	x 10^5 dyne/cm^2	10.3	6.9
Knoop Hardness	Kg/mm^2	210-240	150-165
Density	g/cm^3	4.08	4.09
Poisson's Ratio		0.27	0.27

Multiply dyne/cm^2 x 1.45 x 10^{-5} to give PSI *@10.6 µm **@.633 µm

ZnS Multispectral Transmission Spectrum



ZnS Transmission Spectrum