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High Power Excimer Laser Mirrors

Acton Research high power excimer laser mirrors are multi-layer dielectric coated mirrors designed for use with high energy excimer lasers. These coatings have yielded superior high damage thresholds. Representative reflectance / transmittance curves for these mirrors are shown on the following page.

Acton Research maintains a stock supply of these beam-turning and normal incidence mirrors for fast delivery to your facility. Mirrors and coatings on Acton mirror blanks or customer supplied material can be produced and supplied in volume, keeping the price very competitive.

We also provide excimer laser beam attenuators that allow variation in the amount of laser energy transmitted. Please note that coatings and mirrors for other UV laser wavelengths are also available.Please contact the Optics Sales department for details and pricing.



Standard Mirror Blank Specifications

Material: UV Laser Grade Fused Silica (VUV Grade Calcium Fluoride for 157nm mirrors)

Parallelism: 3 arc minutes • **Chamfer:** 0.5mm x 45˚ nominal • **Clear Aperture:** Central 80%

Surface Figure: ≤ 1/10 wave at 632.8nm • **Surface Finish:** 20-10 scratch-dig

Sizes: 1.0” Dia. x 0.250” thick • 1.5” Dia. x 5mm thick • 2.0” Dia. x 0.375” thick

High Power Excimer Laser Mirrors - Normal Incidence

Excimer Laser Wavelength	Reflectance at N.I.	Mirror Part Numbers 1.0” Dia. (25.4mm)	1.5” Dia. (38.1mm)	2.0” Dia. (50.8mm)
157nm (F_2)	≥91%	157-FR-1D-FLC	157-FR-1.5D-FLC	157-FR-2D-FLC
193nm (ArF)	≥97%	193-FRE-1D-MB	193-FRE-1.5D-MB	193-FRE-2D-MB
248nm (KrF)	≥98%	248-FR-1D-MB	248-FR-1.5D-MB	248-FR-2D-MB
308nm (XeCl)	≥98%	308-FR-1D-MB	308-FR-1.5D-MB	308-FR-2D-MB
353nm (XeF)	≥99%	353-FR-1D-MB	353-FR-1.5D-MB	353-FR-2D-MB

High Power Excimer Laser Mirrors - 45˚ Angle of Incidence

Excimer Laser Wavelength	Reflectance at 45˚	Mirror Part Numbers 1.0” Dia. (25.4mm)	1.5” Dia. (38.1mm)	2.0” Dia. (50.8mm)
157nm (F_2)	≥89%	157-FR45-1D-FLC	157-FR45-1.5D-FLC	157-FR45-2D-FLC
193nm (ArF)	≥97%	193-FR45E-1D-MB	193-FR45E-1.5D-MB	193-FR45E-2D-MB
248nm (KrF)	≥97%	248-FR45-1D-MB	248-FR45-1.5D-MB	248-FR45-2D-MB
308nm (XeCl)	≥97%	308-FR45-1D-MB	308-FR45-1.5D-MB	308-FR45-2D-MB
353nm (XeF)	≥98%	353-FR45-1D-MB	353-FR45-1.5D-MB	353-FR45-2D-MB

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High Power Excimer Laser Mirrors

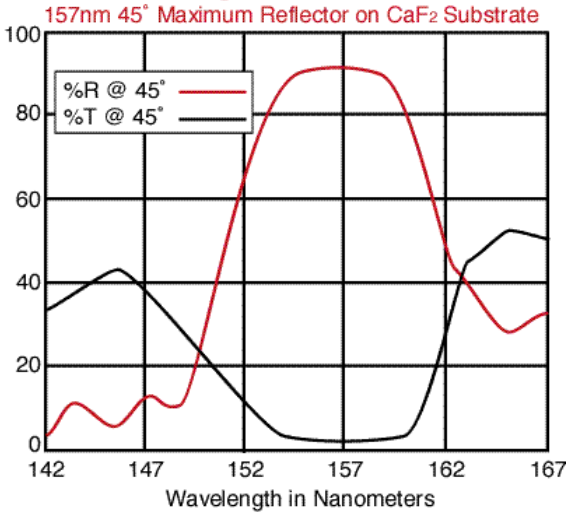
Damage Threshold Information

Damage thresholds for these excimer laser mirrors were tested with a pulse duration of 15-20ns, on clean, uncontaminated coatings. Repetition rates in some tests were as high as 100hz, and coatings were applied to UV fused silica substrates.

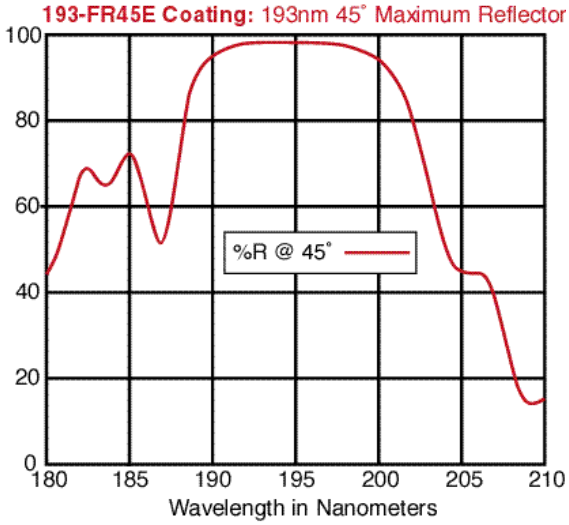
Coating Type (N.I.)	Coating Type (45˚)	Damage Threshold
157-FR	157-FR45	0.3-0.75 J/cm^2
193-FR	193-FR45E*	1 - 2 J/cm^2
248-FR	248-FR45	4-7 J/cm^2
308-FR	308-FR45	4-7 J/cm^2
353-FR	353-FR45	4-7 J/cm^2

* Due to the superior reflectance and laser damage resistance of our 193-FR45E coating, we have now made it the standard 193nm front-surface coating.

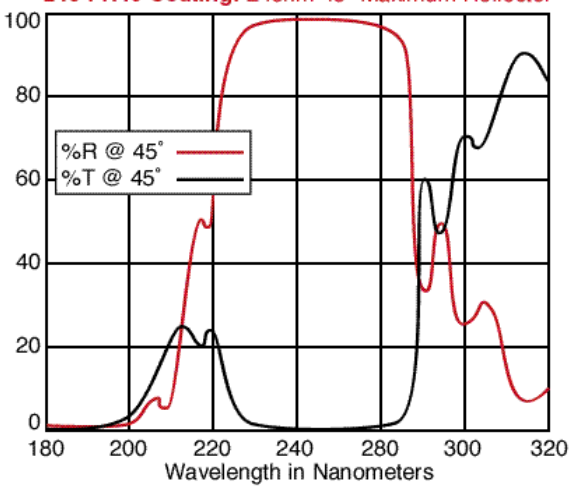
157-FR45 Coating:
157nm 45˚ Maximum Reflector on CaF_2 Substrate



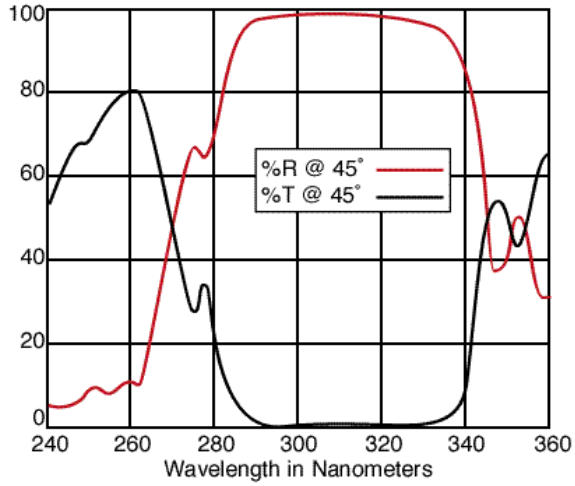
193-FR45E Coating: 193nm 45˚ Maximum Reflector



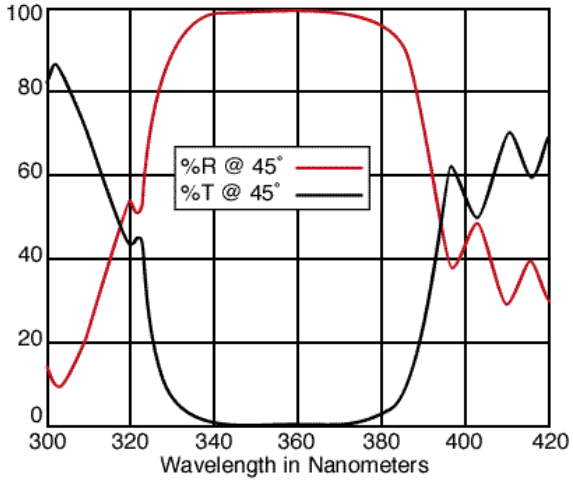
248-FR45 Coating: 248nm 45˚ Maximum Reflector



308-FR45 Coating: 308nm 45˚ Maximum Reflector



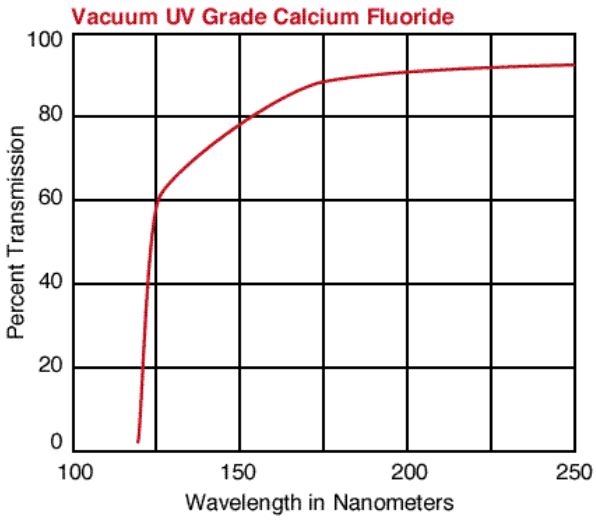
353-FR45 Coating: 353nm 45˚ Maximum Reflector



Standard Window & Substrate Materials

These curves illustrate the transmittance properties of Acton Research's standard windows and substrate materials (windows 2-3mm thick).

Please note that transmittance can vary slightly, therefore these curves should be used for reference only.

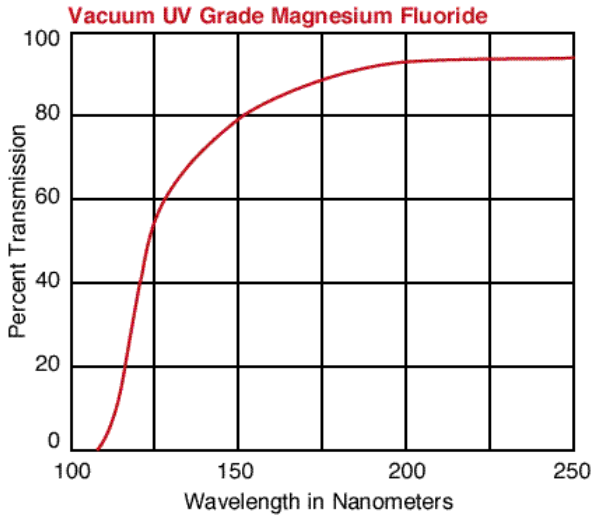


VUV Grade Calcium Fluoride (CaF_2)

Calcium Fluoride is cubic single crystal optical material with good vacuum UV to infrared transmittance properties. Advantages of calcium fluoride are its low birefringent properties and its availability in a variety of different grades.

Chemically pure grades of CaF_2 are used as excimer laser windows, lenses, prisms and filter substrates. Care should be taken when handling CaF_2 as it is sensitive to thermal shock.

Wavelength	157nm	193nm	248nm	308nm	353nm
*Refractive Index	1.500	1.492	1.469	1.460	1.445



VUV Grade Magnesium Fluoride (MgF_2)

Magnesium Fluoride is an optical crystal with high transmittance from the vacuum ultraviolet to the infrared. It is provided with surfaces cut perpendicular to the C-axis to minimize birefringent properties.

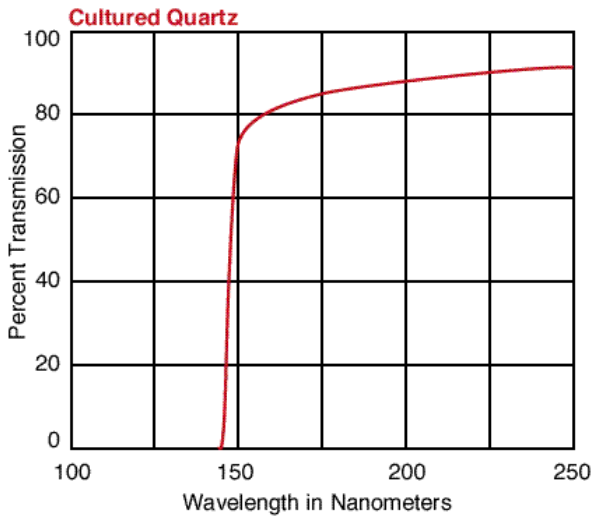
Due to its chemical composition, it is a proven material for use in fluorine environments as an excimer laser window.

Wavelength	157nm	193nm	248nm	308nm	353nm
*Refractive Index	1.464	1.428	1.415	1.405	1.387

*Approximate values

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Standard Window & Substrate Materials

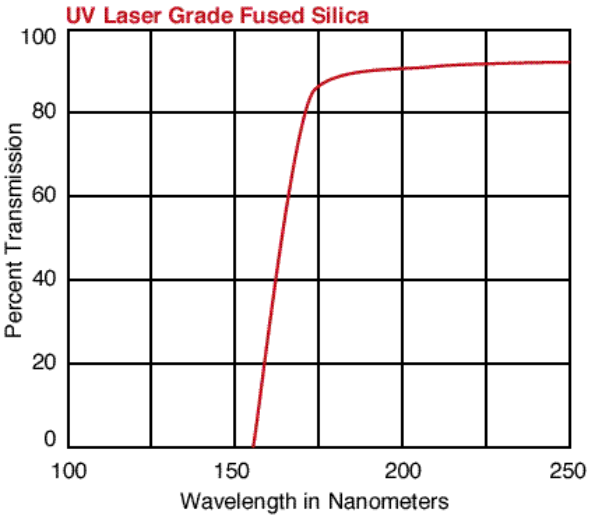


Cultured Quartz

Cultured quartz is a grown crystalline form of silicon dioxide. It is very hard, with a low expansion coefficient and transmits light through the range of 147nm (vacuum ultraviolet) to 4.5 microns (infrared).

It is primarily used for deep UV windows, VUV filter substrates and cut-off filters due to the sharpness of the cut-off at 147nm.

Wavelength	157nm	193nm	248nm	308nm	353nm
*Refractive Index	1.660	1.562	1.508	1.486	1.476



UV Laser Grade Fused Silica

UV Laser Grade Fused Silica is a widely used synthetic glass for UV laser windows and lenses. It has excellent transmission from 170nm to approximately 2.5µm and minimal fluorescence.

There are a number of special grades of fused silica with high chemical purity and excellent homogeneity in one direction.

Wavelength	170nm	193nm	248nm	308nm	353nm
*Refractive Index	1.611	1.561	1.508	1.485	1.476

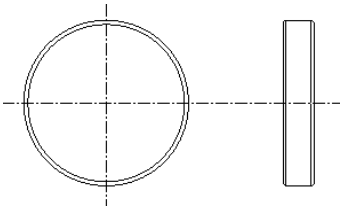
*Approximate values

Windows

Acton Research windows are made from select grades of the finest available materials. VUV-UV windows are suitable for general VUV-UV applications. Flat laser windows are suitable for high power laser applications and as substrates for mirrors and beamsplitters.

Windows are available with transmittance traces for an additional charge. See pages 14-15 for typical transmittance properties and descriptions of materials. These windows are available with high efficiency anti-reflection coatings described on pages 8-9 of this catalog.

Plano / Plano Design



Flat Laser Windows

Material	Diameter	Thickness	Part #
UV Laser Grade Fused Silica	1.000" (25.4mm)	0.250"	1D-FL
VUV MgF_2	1.000"	0.250"	1D-FLM
VUV CaF_2	1.000"	0.250"	1D-FLC
UV Laser Grade Fused Silica	1.500" (38.1mm)	5mm	1.5D-FL
VUV MgF_2	1.500"	5mm	1.5D-FLM
VUV CaF_2	1.500"	5mm	1.5D-FLC
UV Laser Grade Fused Silica	2.000" (50.8mm)	0.375"	2D-FL
VUV MgF_2	2.000"	0.375"	2D-FLM
VUV CaF_2	2.000"	0.375"	2D-FLC
UV Laser Grade Fused Silica	2.000" (50.8mm)	5mm	2D5-FL
VUV MgF_2	2.000"	5mm	2D5-FLM
VUV CaF_2	2.000"	5mm	2D5-FLC

Flat Laser Window Specifications

Surface Figure: ≤ 1/10 wave both surfaces @ 632.8nm

Surface Finish: 20-10 scratch-dig

Parallelism: 3 arc minutes

Chamfer: 0.5mm x 45° nominal

Clear Aperture: Central 80%

Diameter Tolerance: + 0.00" / - 0.005"

Thickness Tolerance: ± 0.25mm

Other sizes are available on request.

VUV-UV Grade Windows

Material	Diameter	Thickness	Part #
VUV MgF_2	0.5" (12.7mm)	2mm	MF-.5D
VUV CaF_2	0.5"	2mm	CF-.5D
Cultured Quartz	0.5"	2mm	CQ-.5D
UV Grade Fused Silica	0.5"	2mm	FS-.5D
VUV MgF_2	1.0" (25.4mm)	2.5mm	MF-1D
VUV CaF_2	1.0"	2.5mm	CF-1D
Cultured Quartz	1.0"	2.5mm	CQ-1D
UV Grade Fused Silica	1.0"	2.5mm	FS-1D
VUV MgF_2	1.5" (38.1mm)	5mm	MF-1.5D
VUV CaF_2	1.5"	5mm	CF-1.5D
Cultured Quartz	1.5"	5mm	CQ-1.5D
UV Grade Fused Silica	1.5"	5mm	FS-1.5D
VUV MgF_2	2.0" (50.8mm)	5mm	MF-2D
VUV CaF_2	2.0"	5mm	CF-2D
UV Grade Fused Silica	2.0"	4mm	FS-2D
VUV MgF_2	2.0" sq. (50.8mm)	5mm	MF-2S
VUV CaF_2	2.0" sq.	5mm	CF-2S
UV Grade Fused Silica	2.0" sq.	4mm	FS-2S

VUV-UV Grade Window Specifications

Surface Figure: ≤ 2 waves at 632.8nm, both surfaces.

Surface Finish: 20-10 scratch-dig both surfaces.

Parallelism: 3 arc minutes or better

Chamfer: 0.5mm x 45° nominal

Clear Aperture: Central 80%

Diameter Tolerance: +.000" / -.005"

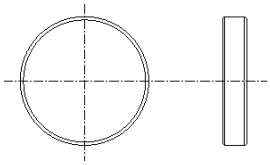
Thickness Tolerance: ± 0.25mm

Other sizes are available on request.

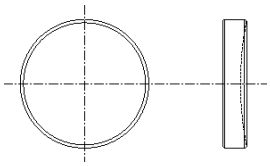
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Mirror Blanks

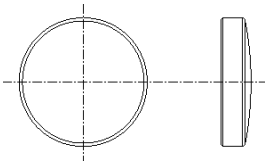
Plano / Plano Design



Plano / Concave Design



Plano / Convex Design



Mirror Blanks

(plano / plano)

Diameter	Material	Thickness	Part #
0.500" (12.7mm)	UV Laser Grade Fused Silica	0.250"	.5D-MB
1.000" (25.4mm)	UV Laser Grade Fused Silica	0.250"	1D-MB
1.500" (38.1mm)	UV Laser Grade Fused Silica	5mm	1.5D-MB
2.000" (50.8mm)	UV Laser Grade Fused Silica	0.375"	2D-MB
2.000" (50.8mm)	UV Laser Grade Fused Silica	5mm	2D5-MB

Specifications

Surface Figure: 1/10 wave - 1st surface @ 632.8nm
1/4 wave - 2nd surface

Polished Surface Finish: 20-10 scratch-dig

Parallelism: 3 arc minutes

Chamfer: 0.5mm x 45° nominal

Clear Aperture: Central 80%

Thickness Tolerance: ± 0.25mm

Diameter Tolerance: + 0.00" / - 0.005"

Other sizes are available on request.

Curved Mirror Blanks

Diameter	Radius of Curvature	Plano / Concave Part #	Plano / Convex Part #
0.5"(12.7mm)	0.1 meter	.5D-.1M	.5D-.1MX
0.5"	0.25 meter	.5D-.25M	
0.5"	0.5 meter	.5D-.5M	.5D-.5MX
0.5"	1 meter	.5D-1M	.5D-1MX
0.5"	2 meter	.5D-2M	
0.5"	3 meter	.5D-3M	
0.5"	4 meter	.5D-4M	
0.5"	5 meter	.5D-5M	
0.5"	10 meter	.5D-10M	
1.0"(25.4mm)	0.1 meter	1D-.1M	1D-.1MX
1.0"	0.25 meter	1D-.25M	
1.0"	0.5 meter	1D-.5M	1D-.5MX
1.0"	1 meter	1D-1M	1D-1MX
1.0"	2 meter	1D-2M	1D-2MX
1.0"	3 meter	1D-3M	1D-3MX
1.0"	4 meter	1D-4M	1D-4MX
1.0"	5 meter	1D-5M	1D-5MX
1.0"	10 meter	1D-10M	1D-10MX
1.5"(38.1mm)	0.1 meter		1.5D-.1MX
1.5"	0.25 meter	1.5D-.25M	
1.5"	0.5 meter	1.5D-.5M	1.5D-.5MX
1.5"	1 meter	1.5D-1M	1.5D-1MX
1.5"	2 meter	1.5D-2M	1.5D-2MX
1.5"	3 meter	1.5D-3M	
1.5"	4 meter	1.5D-4M	1.5D-4MX
1.5"	5 meter	1.5D-5M	1.5D-5MX
1.5"	10 meter	1.5D-10M	
2.0"(50.8mm)	0.25 meter	2D-.25M	
2.0"	0.5 meter	2D-.5M	2D-.5MX
2.0"	1 meter	2D-1M	2D-1MX
2.0"	2 meter	2D-2M	2D-2MX
2.0"	3 meter	2D-3M	2D-3MX
2.0"	4 meter	2D-4M	2D-4MX
2.0"	5 meter	2D-5M	2D-5MX
2.0"	10 meter	2D-10M	2D-10MX

Specifications

Material: UV Laser Grade Fused Silica

Surface Figure: ≤ 1/10 wave both surfaces at 632.8nm

Surface Finish: 20-10 scratch-dig, both surfaces

Chamfer: 0.35mm x 45° nominal • **Clear Aperture:** Central 80%

Edge Thickness: 0.375" • **Dia. Tolerance:** ± 0.005"

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