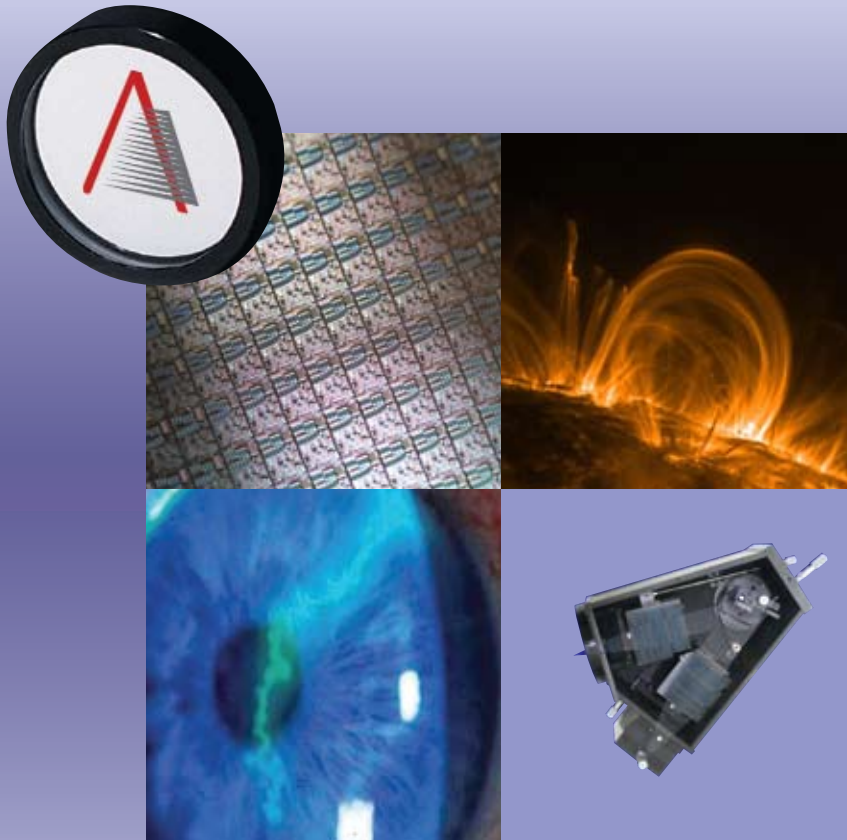


# OPTICS & COATINGS

120nm - 1064nm



Semiconductor | Aerospace | Laser | Analytic Instruments

Dear Colleague,

Thank you for your interest in Acton Optics & Coatings. Since its founding in 1961 as Acton Research Corporation, Acton has enjoyed a long history of success. For nearly a half a century the Acton name has been associated with the highest quality optics and spectrometers.

Now a part of Princeton Instruments, a subsidiary of Roper Industries (ROP:NYSE), Acton Optics & Coatings retains a small company's entrepreneurial spirit, combined with the added benefits and strength of multi-national corporate resources. Acton Optics & Coatings is ISO 9001:2000 certified and maintains the commitment to meet each customer's specific requirements through the continuous improvement of our quality management system. In addition, our on-time delivery record is one of the best in the industry and our rigorous process control provides world-class, batch-to-batch repeatability that is a requirement of OEM customers.

We welcome you to browse these pages, familiarizing yourself with our new and innovative product offerings. For more than forty years we have pioneered the development of many high reflectance coatings, optical interference filters and high power Excimer and UV laser optics. Use this catalog as a general guide of our capabilities, and then contact us to discuss your project's requirements.

Among the many choices you have for suppliers, our commitment to produce custom designs and products to meet your specific application is unique. Our emphasis continues to be on the research and development of cutting-edge optical technologies, so we may offer to you the highest performance and longest-lifetime optics available.

Please contact our knowledgeable sales and design staff by phone at 978-263-3584 to discuss your application's specific requirements. We look forward to addressing your next challenge!

Sincerely,

Mark Dykstra  
General Manager



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# Capabilities and Core Competencies

As technology evolves and advances, so does the demand for high-performance optics and coatings. Acton Optics & Coatings is dedicated to continuous improvement of our products and processes to meet the demands of emerging applications. We are focused on providing the highest performance optical components and optical sub-assemblies for Semiconductor, Laser, Medical, Analytic Instrument, Imaging and other emerging markets.

## **Proprietary In Situ Optical Monitoring System (OMS)**

Precise deposition control of coating materials is a critical component in controlling coating stress. Acton's proprietary V3 OMS allows for precise control of quarter-wave and non-quarter wave layer thicknesses to  $\pm 8$  angstroms. This means that complex coatings requiring difficult non-quarter wave designs can be produced with consistent batch-to-batch repeatability and controlled stress.

## **Optical Metrology**

Acton can provide validated spectral data to our customers by measuring finished coatings for both reflectance and transmission using the most advanced metrology systems in the industry. These systems provide spectral and optical inspection that far surpass those available commercially. Our widely respected Acton CAMS spectrophotometers can spectrally measure optics in air, under vacuum, or with  $N_2$  purging, duplicating the environmental conditions of your application. This unique capability allows us to offer definitive spectral measurements in those cases where the validity of a third party's spectral test data might come into question. We are one of very few coating companies with the capability to accurately measure wavelengths as low as 120nm.

## **Coating Materials**

There are a limited number of materials to choose from when coating in the UV and DUV, consisting mainly of fluorides and a small group of oxides. Fluoride materials present the largest set of challenges when attempting durable full reflector coatings and complex multi-wavelength coatings. This is due to a smaller index of refraction difference between high and low index materials, requiring the deposition of more pairs of material to reach maximum reflectance. This affects the overall coating stress which may lead to cracking and crazing in the film structure which can lead to coating failure. To avoid this problem, Acton Optics & Coatings characterizes all coating materials used in the processes for refractive index,  $n&k$  values and coating stress. Coating materials are tested under E-beam deposition, ion-assisted deposition and thermal evaporation as well as at different chamber temperatures. Studying and understanding this data allows Acton to design coatings specific to our customers' applications, which meet or exceed the required specifications.

## **ISO 9001:2000 Certification**

Acton Optics & Coatings is ISO 9001:2000 certified and maintains the commitment to meet each customer's specific requirements through the continuous improvement of our quality management system. In addition, our on-time delivery record is close to 100%, one of the best in the industry. Further, our rigorous process control provides world-class, batch to batch repeatability that is a requirement of OEM customers.



# Acton Optics & Coatings Timeline

- 1960
- Acton Research incorporated in 1961
  - Designs and produces VUV broadband aluminum coatings for spectrometers including the #1200, #1600 and the industry standard #1900
  - Develops VUV/UV bandpass filters - yields first narrow and broadband filters down to 190nm
- 1970
- Produces laser mirrors with developers of first excimer laser systems. Mirrors produced for 126nm, 157nm, 172nm and 193nm
  - First commercial customers (OEMs) for filters, HIR VUV coatings, & replica optics
  - Provides optics to NASA for Apollo/Soyuz mission in 1975
  - Produces the first commercially available Lyman-Alpha (121.6nm) filters
- 1980
- Continues development of excimer laser coatings for higher reflectance and increased laser damage threshold
  - Introduces new products including reflective filters, MUVBS, ND filters and solar blind filters
  - Supplies optics for the Viking and Freja space projects
- 1990
- Provides optics for emerging excimer laser applications including semiconductor, medical and industrial markets
  - Becomes preferred supplier for high-reflectance long-lifetime optics
  - Provides optics for Cassini, Hubble, UVES/SOHO, TRACE and WISP missions
- 2000
- Develops new proprietary in situ optical monitoring system (OMS) capable of controlling coating layer deposition to +/- 8 angstroms,
  - Enables development of the 193 e and 193 XL coatings capable of next generation rep rate and peak power requirements
  - Continues improvement in process, coating and photo-contamination control techniques
  - Increases global presence with the enhanced international representation
  - Achieves ISO 9000-2001 certification
  - Provides optics for Lyra and Solar Dynamics Observatory missions



# Excimer Laser Optics

## Beam-Turning and Cavity Optics

Our excimer laser mirrors are multi-layer dielectric coated mirrors designed for use with high energy excimer lasers. These coatings yield superior reflectance while meeting high damage threshold requirements. With nearly forty years experience designing and developing excimer coatings, Acton can design coatings to match your spectral, polarization and application requirements. We maintain a stock supply of these beam turning and normal incidence mirrors for fast delivery to your facility. Mirrors and coatings can be supplied on Acton mirror blanks or customer supplied material. Excimer optics can be produced and supplied in volume, keeping the price very competitive. We can also provide you with “ready to install” optical assemblies utilizing our highly trained technicians and clean room facility.

**Applications: Medical, Semiconductor, Micromachining, Materials Processing**

## Laser Damage Threshold

Many factors influence the damage resistance and lifetimes of excimer laser coatings.

From a design standpoint, understanding the application and laser power requirements are of utmost importance. These laser power specifications include fluence, rep rate, beam size, usage environment and physical damage resistance.

From a manufacturing standpoint, coating material selection, thin film coating design, coating process, quality control, and knowledge of material stress characteristics are crucial contributors to the performance of an optic.



Acton can optimize coatings for customer-specific applications by understanding how each unique excimer laser can differ with varied wavelengths, power, beam profile and lifetime requirements.

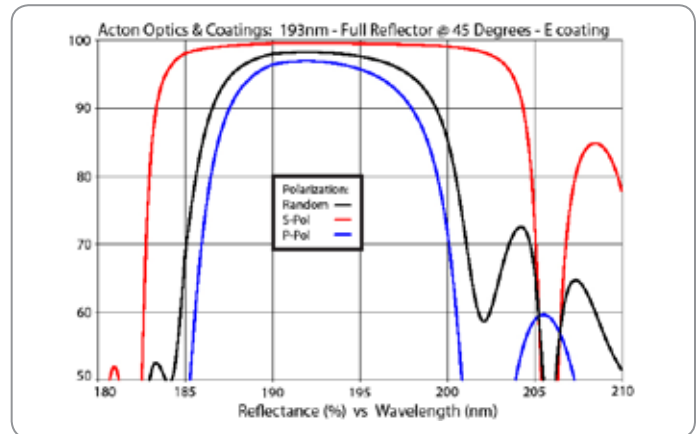
Please contact Acton Optics & Coatings for detailed laser damage threshold benchmarks for our standard coatings.



# Application Specific

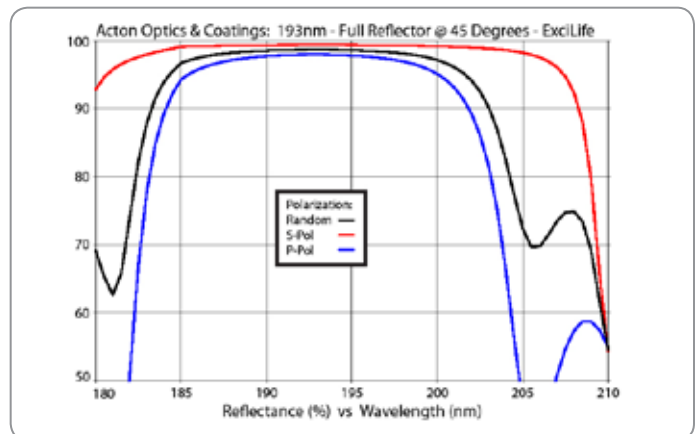
## 193nm e-Design Approach High Fluence - Low Rep. Rate

Designed for applications requiring rep. rates of approximately 200 Hz, the e-design (ref: 193-FR45e) takes electrical field intensity (EFI) -correction to the next level by positioning and distributing EFI peaks within several layers, thus reducing the intensity within any single layer in the stack. This approach diminishes the effect of EFI-related damage resulting in increased laser damage resistance and longer coating lifetimes.

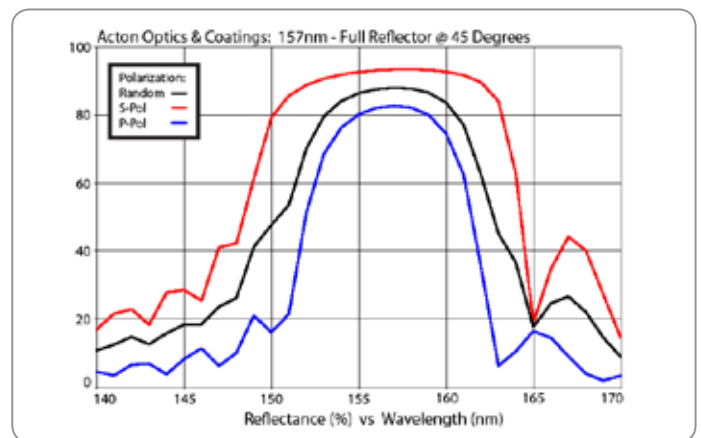
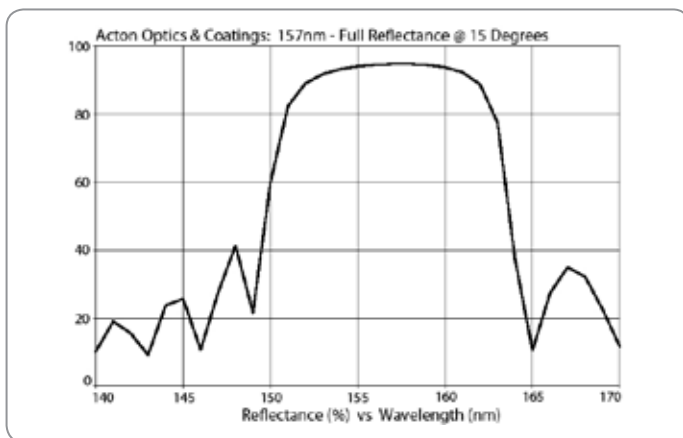
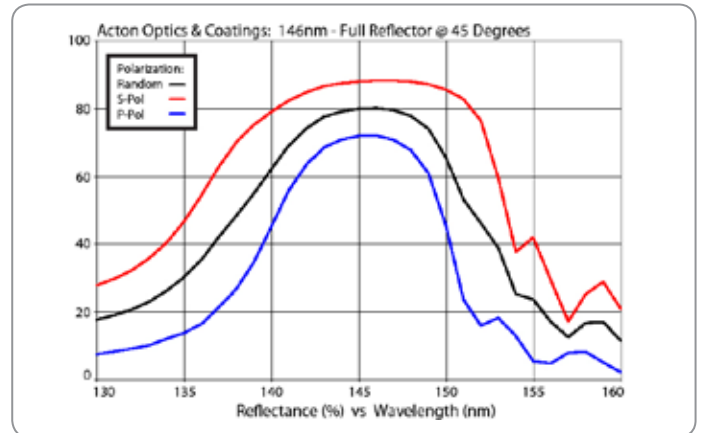
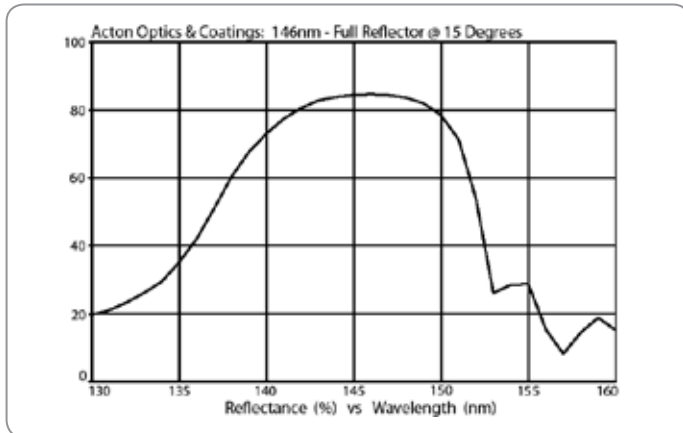
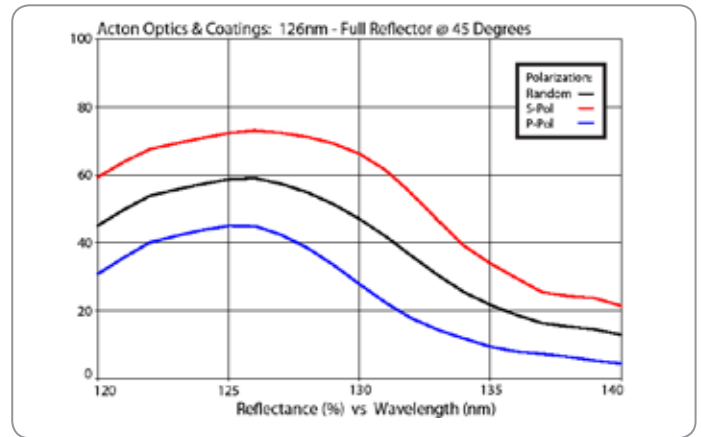
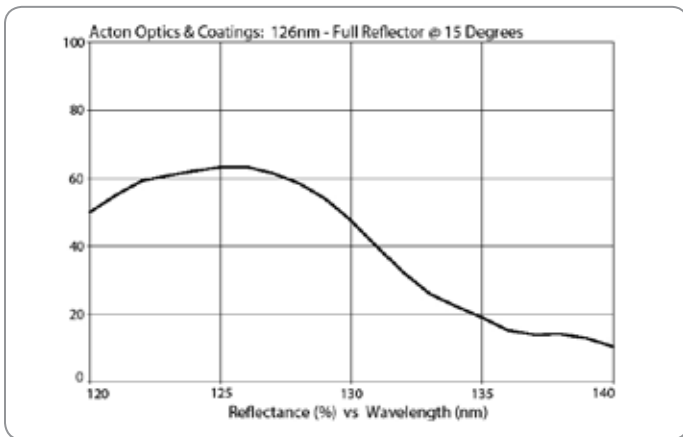


## 193nm XL-Design Approach Low Fluence - High Rep. Rate

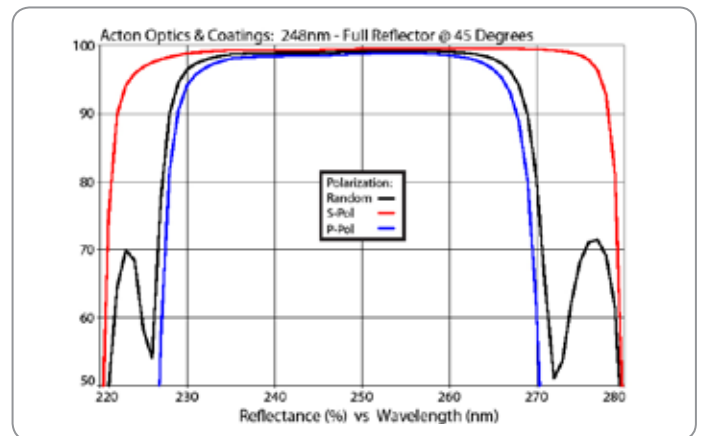
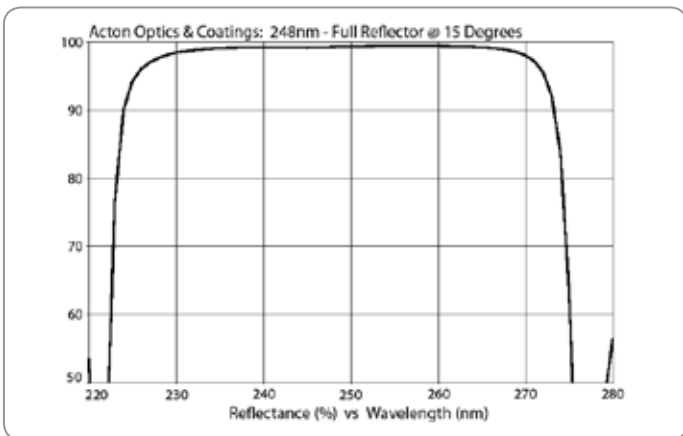
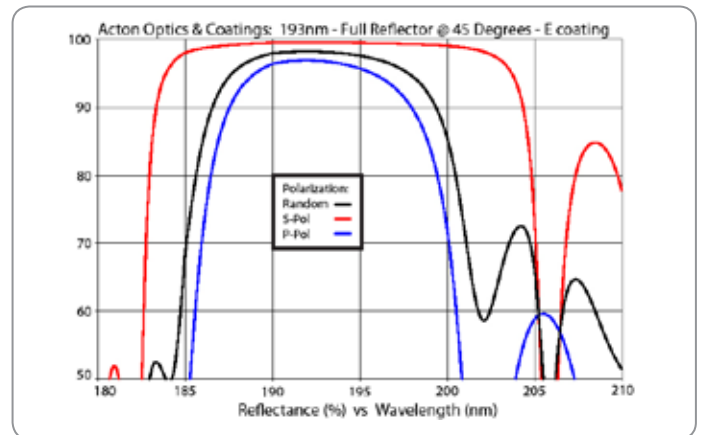
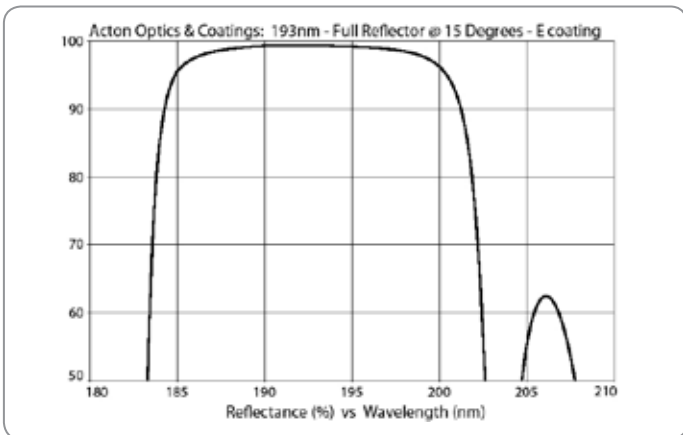
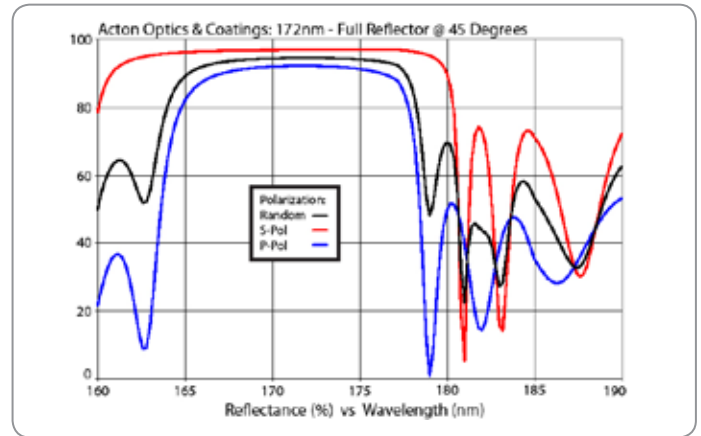
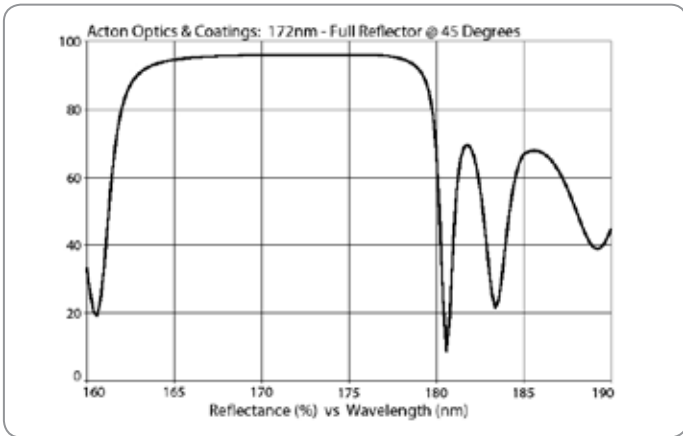
The XL-design (ref: 193-XL45) combines hybrid structure with balanced stress for applications requiring rep. rates of 4-5 kHz. This minimizes the possibility of catastrophic damage due to micro-defects and thermal stress fractures, as well as prevents dehydration effects from high-repetition-rate operation. Reflectance of 95.5-97% at 193nm and phase shift can be optimized to customer's request. This robust UV coating passes MIL-SPEC adhesion, abrasion and humidity tests.



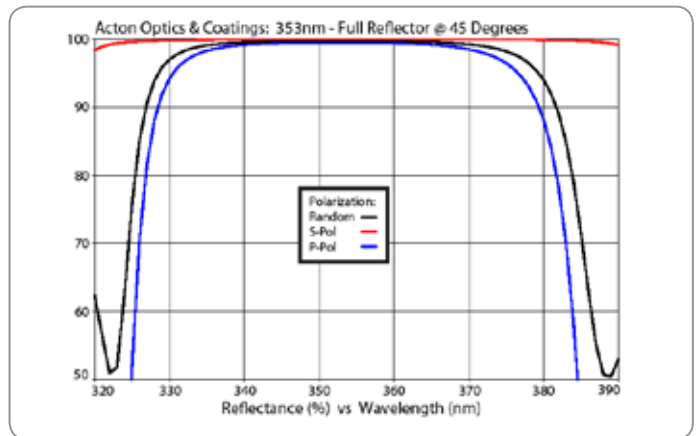
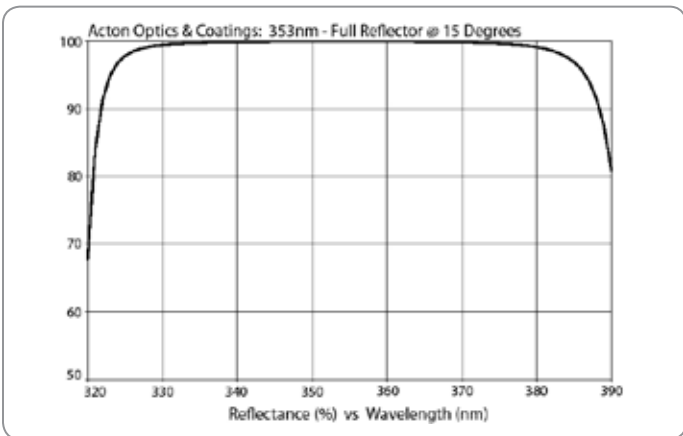
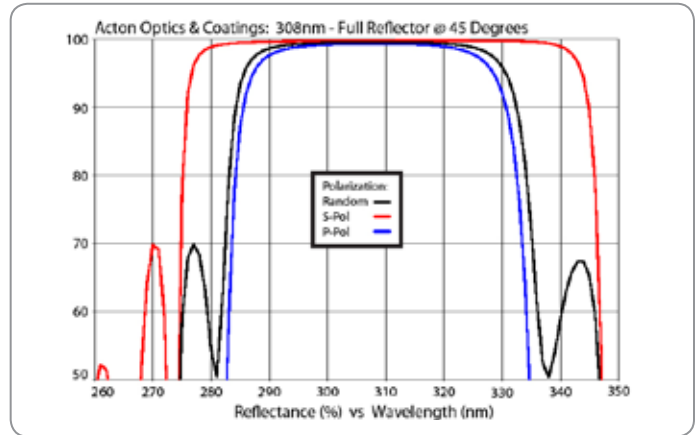
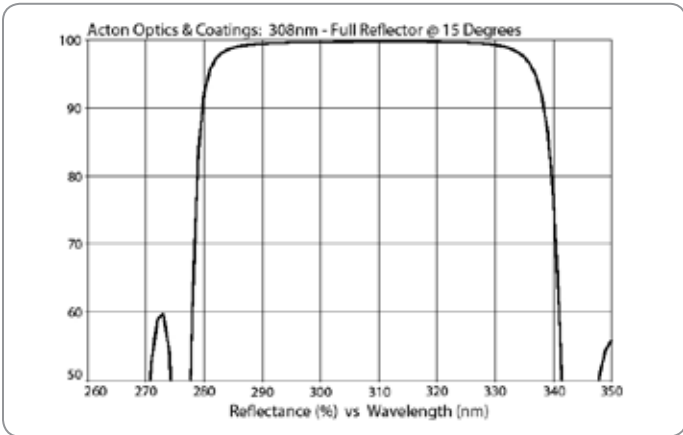
# Excimer Laser Mirror Coatings: 126-157nm



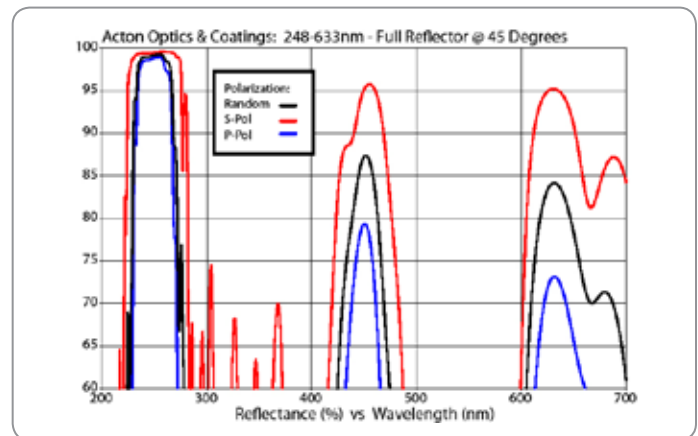
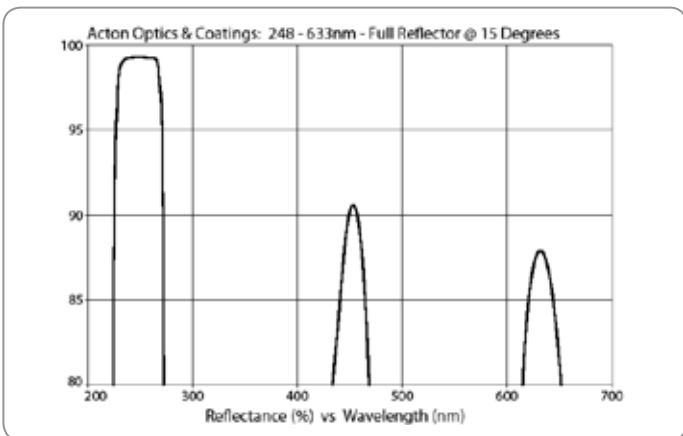
# Excimer Laser Mirror Coatings: 172-248nm



# Excimer Laser Mirror Coatings: 308-353nm



# Excimer Laser Dual-Wavelengths 248-633nm



# Excimer Laser Optics



## Excimer Laser Mirrors - Part Numbers for Standard Optics

Wavelength	% R @ N.I.	Normal Incidence Part Number		% R @ 45°	45° AOI Part Number	
		1" Diameter	2" Diameter		1" Diameter	2" Diameter
126nm	≥ 55%	M126-FR-1D-MB	M126-FR-2D-MB	≥ 50%	M126-FR45-1D-MB	M126-FR45-2D-MB
147nm	≥ 75%	M147-FR-1D-MB	M147-FR-2D-MB	≥ 70%	M147-FR45-1D-MB	M147-FR45-2D-MB
157nm	≥ 89%	M157-FR-1D-MB	M157-FR-2D-MB	≥ 87%	M157-FR45-1D-MB	M157-FR45-2D-MB
172nm	≥ 93%	M172-FR-1D-MB	M172-FR-2D-MB	≥ 90%	M172-FR45-1D-MB	M172-FR45-2D-MB
193nm e*	≥ 97%	M193-FRe-1D-MB	M193-FRe-2D-MB	≥ 96%	M193-FR45e-1D-MB	M193-FR45e-2D-MB
193nm XL*	≥ 97%	M193-FRXL-1D-MB	M193-FRXL-2D-MB	≥ 95.5%	M193-FRXL45-1D-MB	M193-FRXL45-2D-MB
248nm	≥ 98%	M248-FR-1D-MB	M248-FR-2D-MB	≥ 97%	M248-FR45-1D-MB	M248-FR45-2D-MB
308nm	≥ 98%	M308-FR-1D-MB	M308-FR-2D-MB	≥ 97%	M308-FR45-1D-MB	M308-FR45-2D-MB
353nm	≥ 99%	M353-FR-1D-MB	M353-FR-2D-MB	≥ 98%	M353-FR45-1D-MB	M353-FR45-2D-MB

## Dual Wavelength Excimer Laser Mirrors - Part Numbers for Standard Optics

Wavelength Range	Normal Incidence Part Number		1" Diameter	2" Diameter
	248nm % R @ N.I.	633nm % R @ N.I.		
248/633nm	≥ 97%	≥ 80%	M248/633-FR-1D-MB	M248/633-FR-2D-MB

Wavelength Range	45° AOI Part Number		1" Diameter	2" Diameter
	248nm % R @ 45°	633nm % R @ 45°		
248/633nm	≥ 97%	≥ 80%	M248/633-FR-1D-MB	M248/633-FR-2D-MB

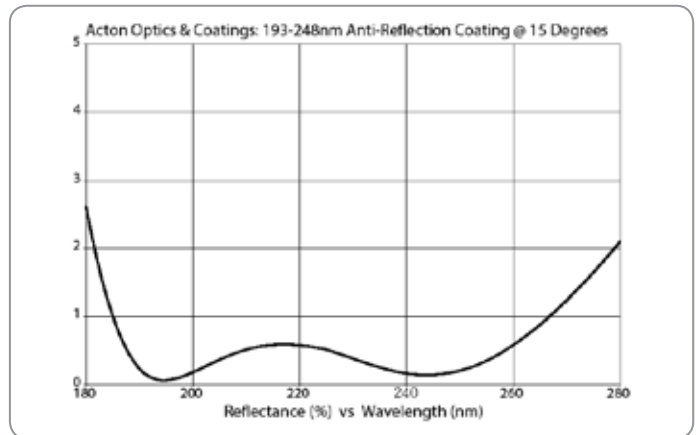
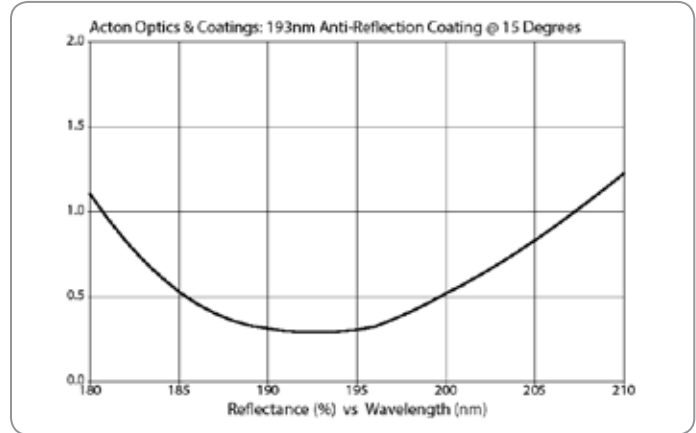
Refer to page 7 for comparison of "e" and "XL" coatings.

Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.

# Excimer Laser Optics

## Anti-Reflection Coatings

Acton's anti-reflection coatings are durable, electron beam deposited dielectrics designed to minimize reflections that normally occur from uncoated surfaces of substrates. These low absorption coatings are ideal for increasing the transmittance properties of lenses, and for reducing the second surface reflections of beamsplitters. Anti-reflection coatings offer excellent resistance to laser damage, and are suitable for high power use. Standard "V-type" anti-reflection coating designs are available for specific wavelengths from 126nm to 353nm. Part numbers are provided for Acton standard stock substrates, specifications can be found on pg. 32-33. Custom coatings, coatings for 45° AOI, and broadband 193-248nm anti-reflection coatings are also available. Please contact Acton for further information.



## Excimer Laser - Anti-Reflection Coated Windows



Wavelength	1" Part Number	2" Part Number	% Reflectance N.I.
126nm	M126-2AR-1D-FL	M126-2AR-2D-FL	≤ 0.5% @ 126nm
147nm	M147-2AR-1D-FL	M147-2AR-2D-FL	≤ 0.5% @ 147nm
157nm	M157-2AR-1D-FL	M157-2AR-2D-FL	≤ 0.5% @ 157nm
172nm	M172-2AR-1D-FL	M172-2AR-2D-FL	≤ 0.3-0.5% @ 172nm
193nm	M193-2AR-1D-FL	M193-2AR-2D-FL	≤ 0.3-0.5% @ 193nm
248nm	M248-2AR-1D-FL	M248-2AR-2D-FL	≤ 0.2-0.5% @ 248nm
308nm	M308-2AR-1D-FL	M308-2AR-2D-FL	≤ 0.2-0.5% @ 308nm
353nm	M353-2AR-1D-FL	M353-2AR-2D-FL	≤ 0.2-0.5% @ 353nm

# Excimer Laser Optics

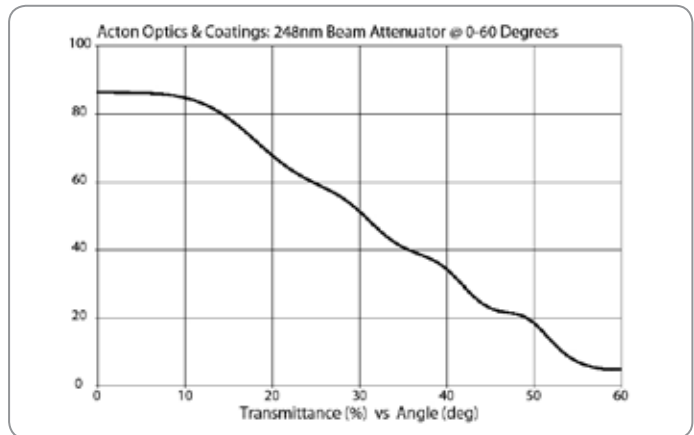
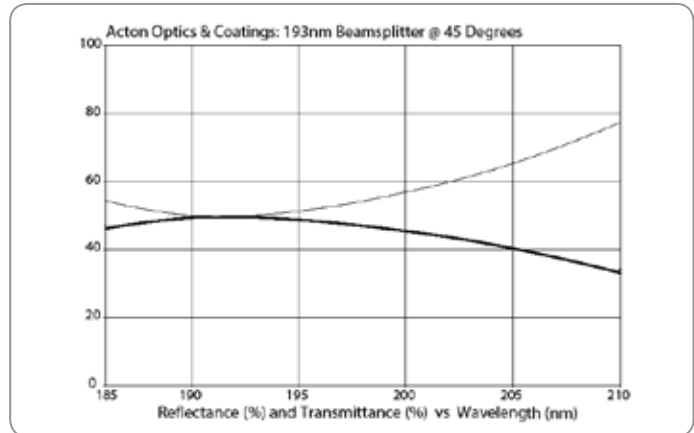
## Beamsplitters and Attenuators

Acton's multi-layer dielectric, low absorption coatings are ideal for output couplers and beam splitting applications. Beamsplitters of all wavelength ranges from 126nm to 353nm are calibrated for reflectance and transmittance at the laser wavelength and angle of incidence specified to ensure excellent performance in high power laser applications. Standard beamsplitters are designed for random polarization. Acton Optics & Coatings can custom design beamsplitters for your application by optimizing for horizontal "P" polarization or vertical "S" polarization and other requirements. Acton Research offers anti-reflection coatings for the rear surface of Beamsplitters, if required. Coatings are available on Acton's standard substrates, see pg 32-33 for more details.

**Applications: Medical, Semiconductor, Micromachining, Materials Processing**

**Combine the coating and the substrate to make a complete part number.**

Ex: 1.0" Diameter, 193nm 10% beamsplitter with 45° AOI = M193-P10-1D-MB



## Excimer Laser Mirrors - Beamsplitters



Beamsplitter Coating Part Numbers (Based on % Transmission)

Standard Substrates

Wavelength	10% +/-2%	30% +/-5%	50% +/-5%	70% +/-5%	90% +/-5%	1" Diameter	2" Diameter
126nm	M126-P1045	M126-P3045	M126-P5045	M126-P7045	M126-P9045	1D-MB	2D-MB
147nm	M147-P1045	M147-P3045	M147-P5045	M147-P7045	M147-P9045	1D-MB	2D-MB
157nm	M157-P1045	M157-P3045	M157-P5045	M157-P7045	M157-P9045	1D-MB	2D-MB
172nm	M172-P1045	M172-P3045	M172-P5045	M172-P7045	M172-P9045	1D-MB	2D-MB
193nm	M193-P1045	M193-P3045	M193-P5045	M193-P7045	M193-P9045	1D-MB	2D-MB
248nm	M248-P1045	M248-P3045	M248-P5045	M248-P7045	M248-P9045	1D-MB	2D-MB
308nm	M308-P1045	M308-P3045	M308-P5045	M308-P7045	M308-P9045	1D-MB	2D-MB
353nm	M353-P1045	M353-P3045	M353-P5045	M353-P7045	M353-P9045	1D-MB	2D-MB

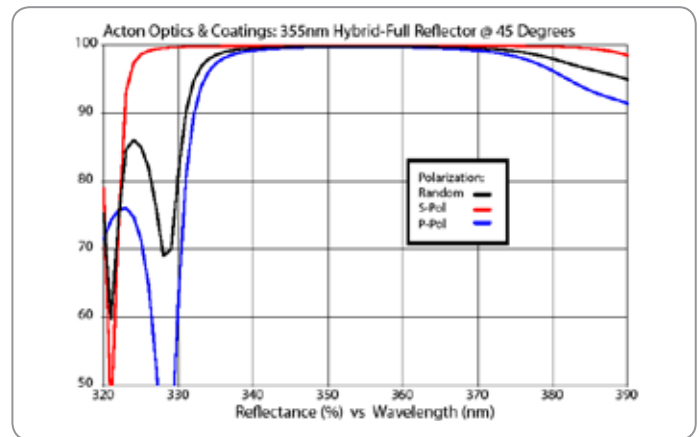
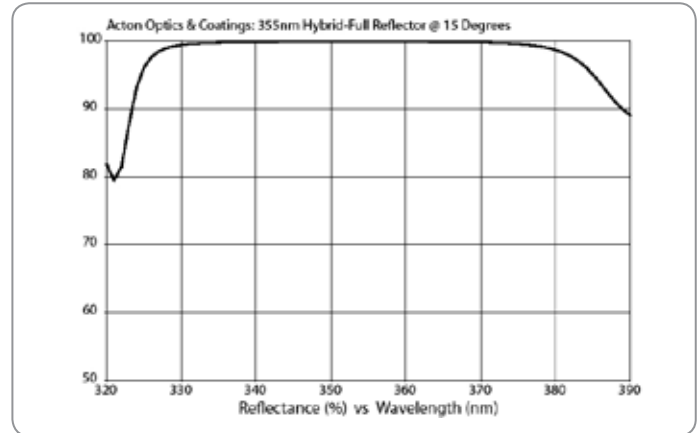
# High-Power Nd:YAG Laser Optics

## 355nm Hybrid Coatings

Acton's new "hybrid" 355nm Nd:YAG coatings combine our extensive expertise in coating deposition and process control to achieve coatings capable of handling high power and high rep. rate.\* Complete mirrors are available on Acton mirror blanks or customer supplied material. Optics can be produced and supplied in volume, keeping the price very competitive. We can also provide you with "ready to install" optical assemblies utilizing our highly trained technicians and clean room facility.

These coatings have endured laser damage threshold testing of 15.27 J/cm<sup>2</sup> at rep rates of up to 100 KHz.

These mirrors are available for normal incidence and 45° AOI.



## 355nm Laser Mirrors



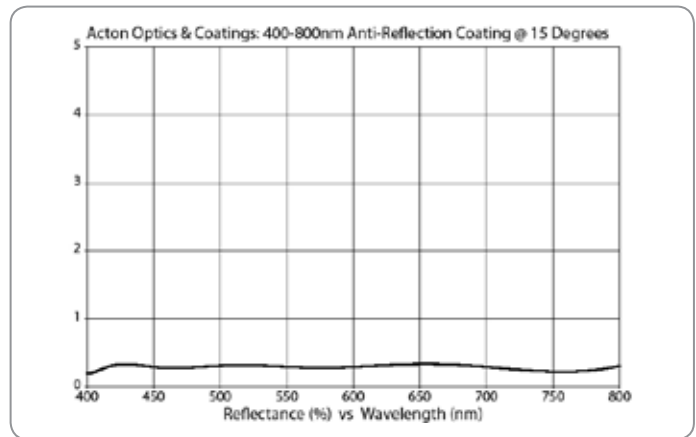
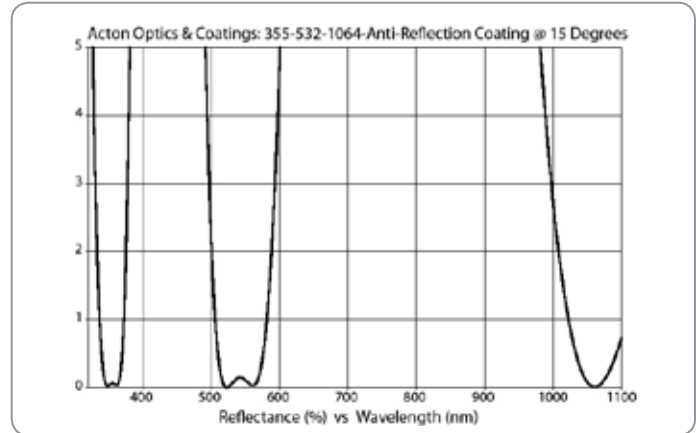
Wavelength	% R @ N.I.	Near Normal Incidence		%R @ 45°	45 Degree AOI	
		Part# 1" Diameter	Part# 2" Diameter		Part# 1" Diameter	Part# 2" Diameter
355	99.9%	M355-FR-HY-1D-MB	M355-FR-HY-2D-MB	≥ 99%	M355-FR45-HY-1D-MB	M355-FR45-HY-2D-MB

Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.

# Broadband Anti-Reflection Coatings

## UV - Visible Coatings

Acton broadband anti-reflection coatings are durable electron beam/ ion assisted deposition coatings that are designed to minimize reflections that normally occur from uncoated surfaces of substrates. These low absorption coatings are ideal for increasing the transmittance properties of lenses, and for reducing the second surface reflections of Beamsplitters. Anti-reflection coatings offer excellent resistance to laser damage, and are suitable for high power use. Coatings available in 400-800nm and 355-532-1064nm versions as well as many custom designs available.



## Broadband Anti-Reflection Coated Windows



Wavelength Range	1" Part Number	2" Part Number	% Reflectance N.I.
355-532-1064nm	M355-532-1064-1D-FL	M355-532-1064-2D-FL	≤ 0.5% Per Wavelength
400-800nm	M400-800-2AR-1D-FL	M400-800-2AR-2D-FL	≤ 0.5% Average
185-950nm	M185-950-2AR-1D-FL	M185-950-2AR-2D-FL	3% Average

Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.

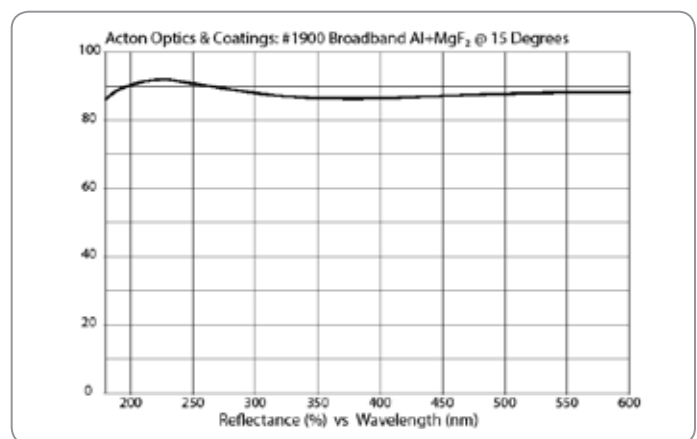
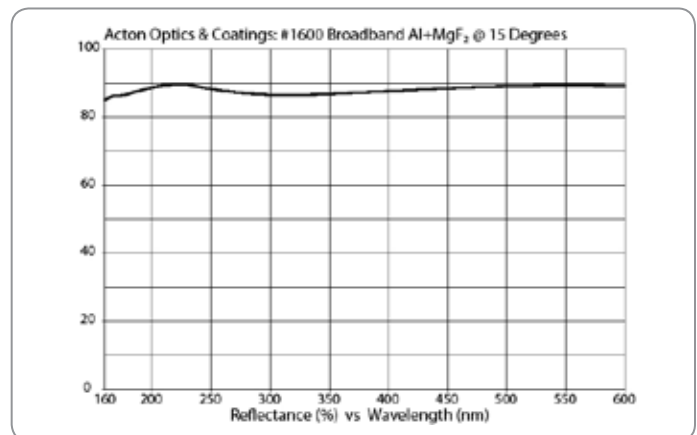
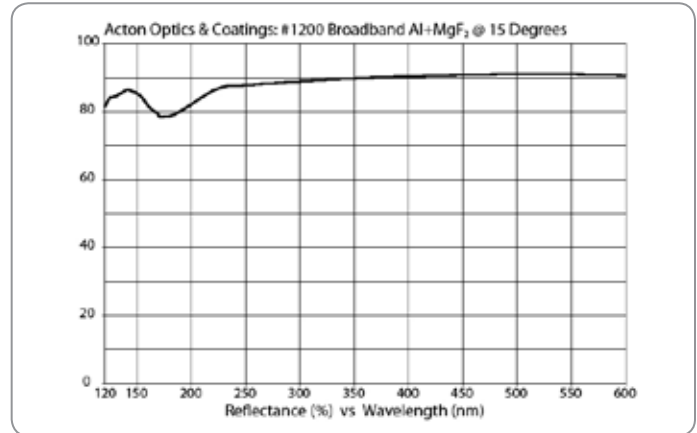
# Broadband Al+MgF<sub>2</sub>

## 120-190nm Coatings

For over four decades, Acton Al+MgF<sub>2</sub> high efficiency coatings have set the standard for broadband UV and VUV reflectance. These coatings are designed to offer industry leading reflectance down to 120nm, with excellent broadband reflectance throughout the visible and near infrared. Coatings are optimized for reflectance at 120nm, 160nm and 190nm for increased light throughput in your application. Each coating lot is measured for reflectance properties to ensure excellent performance of every mirror supplied.

**Applications: DUV Spectrophotometers, Ellipsometry, VUV/UV-based Analytical Instrumentation, ICP Spectrometers, Space Applications**

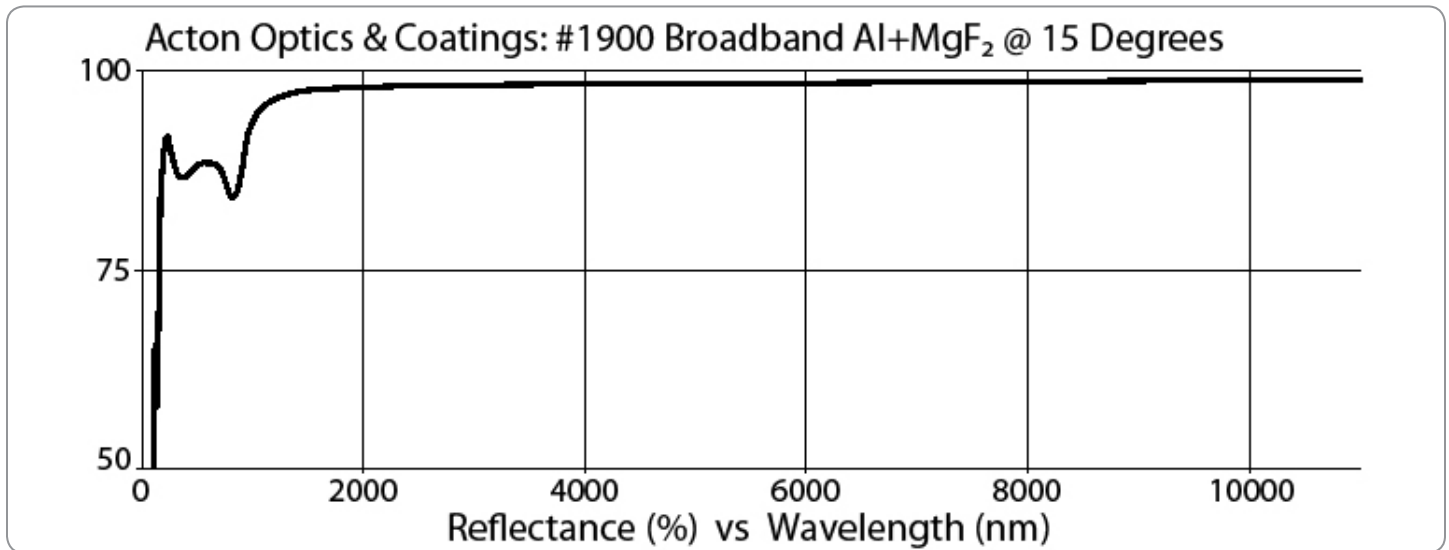
*Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.*



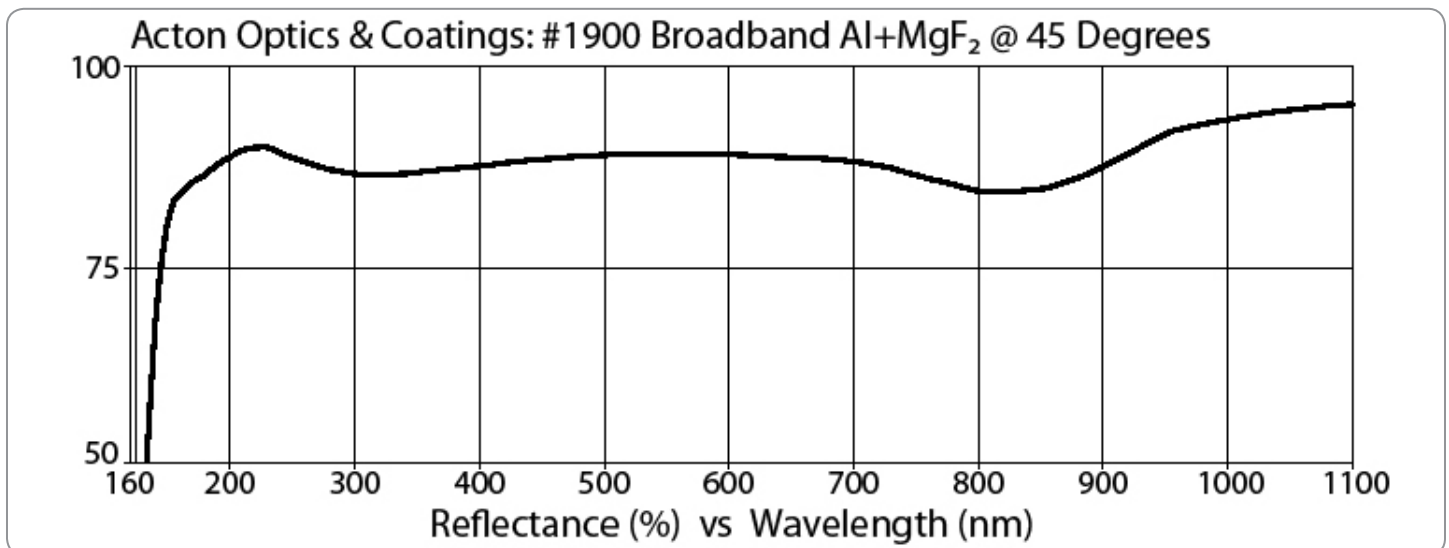
Part Number	Peak Wavelength	Reflectance @ 15 Degrees
#1200	120nm	≥ 78%
#1600	160nm	≥ 84%
#1900	190nm	≥ 88%

# Broadband Al+MgF<sub>2</sub>

#1900 Standard 0-11,000nm at 15 Degrees



#1900 Standard 160-1100nm at 45 Degrees



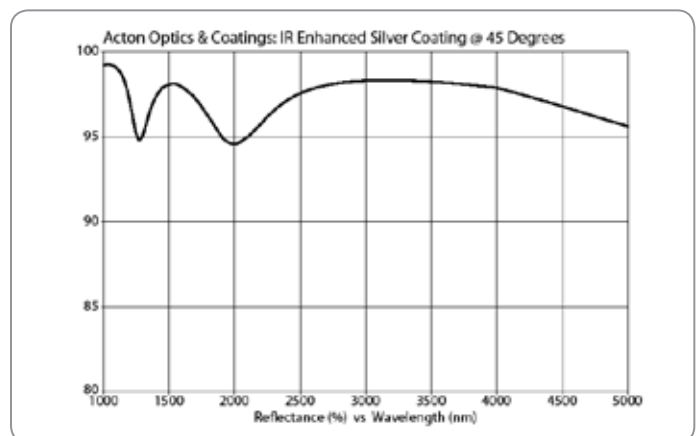
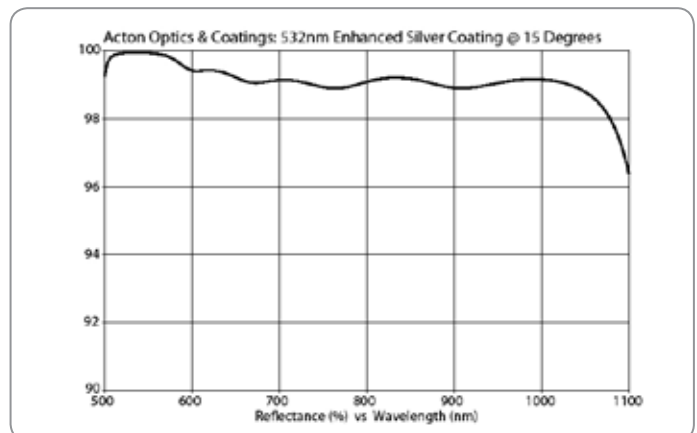
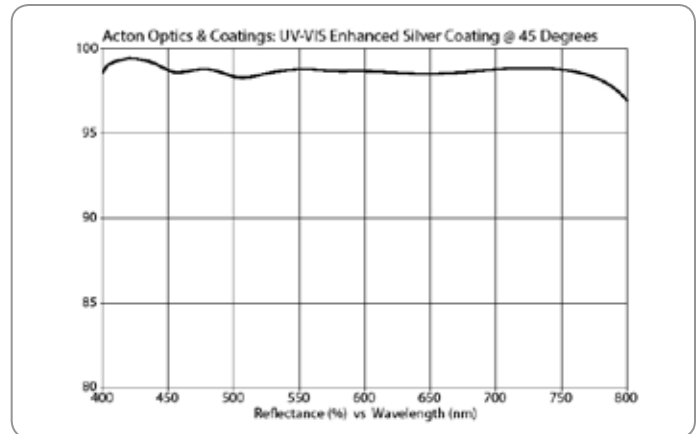
# UV-VIS Silver Coatings

## Protected and Enhanced

Acton Optics & Coatings' protected and enhanced silver mirror coatings offer breakthrough levels of durability and reflectance. These proprietary coatings are offered on a variety of substrates, including diamond-turned aluminum, and are the ideal choice for highest reflectivity from 500nm to 2 $\mu$ . The excellent reflectance and durability can easily be extended into the 3 to 5 $\mu$  range if required. These dependable coatings can be manufactured to provide greater than 98% average reflectance over very broad bandwidths. Coatings have been optimized for visible, NIR, as well as a combination of visible and NIR performance. The longevity of the mirror is maximized by the precise deposition of proprietary binder layers and dielectric overcoat layers carefully selected based upon substrate choice and end user application. This newly developed coating protects diamond-turned substrates from scratches and corrosion.

**Applications: Military Optics, Telescopes, Space Flight Hardware, Analytic Instruments, Ultrafast Ti:Sapphire Lasers**

*Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.*

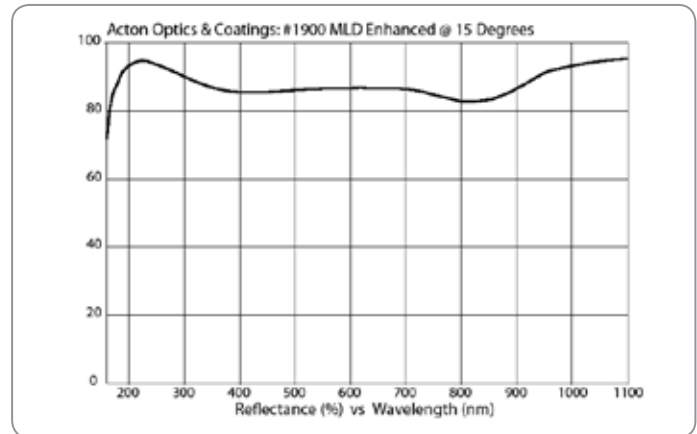
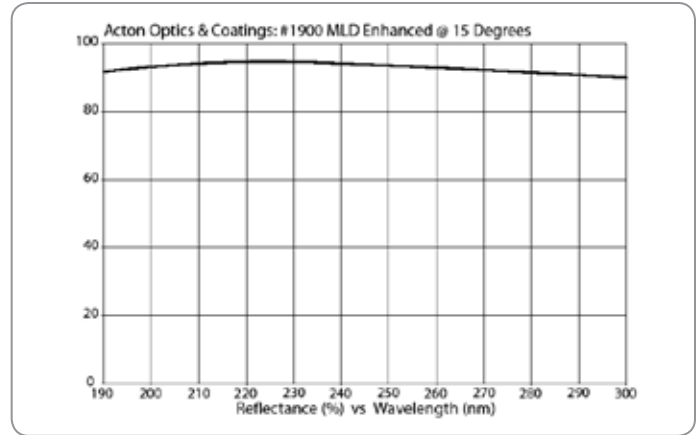


# #1900 Enhanced MLD Coatings

## Durable, Enhanced #1900 Coatings

Acton's new #1900 enhanced, high efficiency coatings have increased reflectance over the critical range of 190-250nm; with enhanced durability. These coatings resist humidity and can be easily cleaned by a simple drag and drop method. Each coating lot is measured for reflectance properties to ensure excellent performance of every mirror supplied.

**Applications: DUV Spectrophotometers, Ellipsometers, VUV/UV-based Analytical instrumentation, ICP Spectrometers, Aerospace Applications**



Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.

## Enhanced Broadband MLD Coated Mirrors



Wavelength	Average %R @ N.I.	Part#	Diameter	Thickness
190-250nm	92-94%	M190-AL/MLD-1D-MB	1.000" (25.4mm)	0.250" (6.35mm)
190-250nm	92-94%	M190-AL/MLD-2D-MB	2.000" (50.8mm)	0.375" (9.53mm)

# UV Bandpass Filters

## Narrow, Broad and Wideband

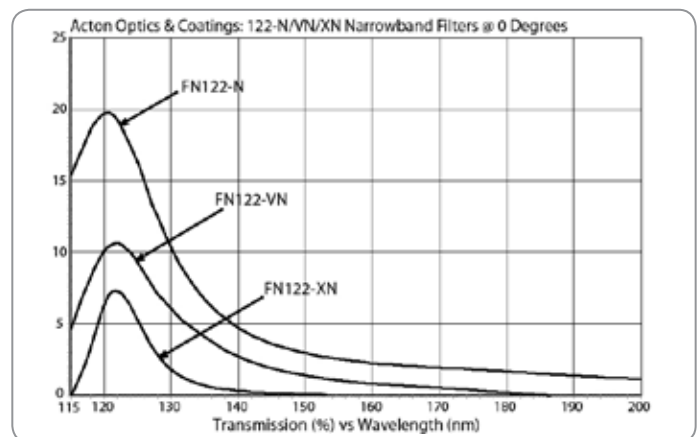
Acton's standard bandpass filters are made from the highest quality optical materials for use in research and industrial applications. Filters are visually and optically inspected before they are shipped, and include individual transmittance curves to show the filter's performance characteristics. Detailed "rejection" curves may be purchased at the time of manufacture. Image quality filters are available on request. Other wavelengths and sizes are available. Please feel free to contact us with details of your OEM filter requirements.

See the following page for examples of transmission traces from selected Acton bandpass filters.



## VUV Filter Characteristics

Acton Optics & Coatings' 121.6nm Lyman Alpha filters demonstrate the effect of bandwidth on transmission in VUV-UV filters. Overall filter transmission is limited due to material and deposition constraints. As bandwidth is decreased, the peak transmission decreases in response. The benefit is added rejection in the UV-VIS range, illustrated by the combined curve diagram to the right, which shows three variations of Acton's 122nm bandpass filters. Depending on the application's required bandwidth, peak transmission and rejection are all factors in the design of the filter. See the following page for examples of transmission traces from selected Acton bandpass filters.



# UV Bandpass Filters

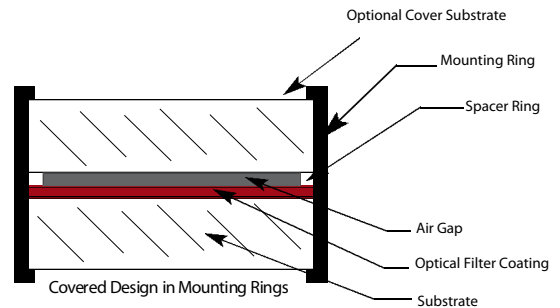
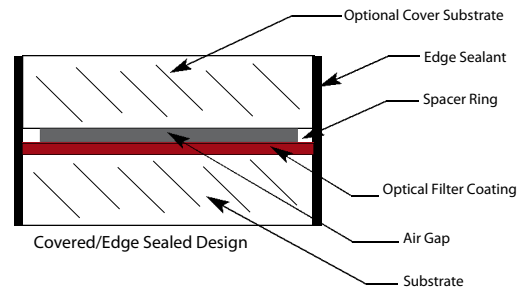
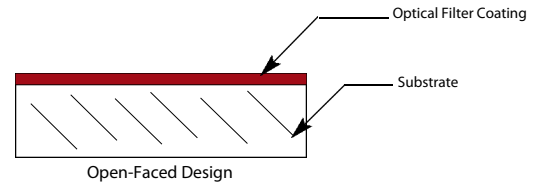
## Available Designs for Standard Bandpass Filters

**Open-Faced** - The open-faced design includes a substrate with an optical filter coating on one surface. Open-faced filters must be handled with care as the soft filter coating is exposed. Potential damage from moisture, atmospheric contaminants or handling can be reduced by sealing the filter with a protective fused silica cover, as shown below (available above 190nm only).

**Covered / Edge Sealed** - Filters above 190nm may be supplied with a fused silica cover for protective purposes. As shown in the diagram, a spacer ring is placed between the substrates to form a small air gap, then the edges are sealed. This design enables the filter to be handled without risk of touching the delicate filter coating. Please note that covering a filter decreases its transmission by 2-3%.

Edge sealing adds approximately 0.010" (0.254mm) to the diameter of the filter. Total thickness for a covered and edge sealed filter is approximately twice that of an open-faced design. Exact dimensions are available from the Optics Sales Department.

**Mounted** - Open-faced or covered filters (without edge sealant) can be supplied in metal mounting rings, if desired. The rings are constructed from aluminum and are black anodized. Mounting a filter reduces clear aperture and increases the outside diameter as outlined below.



## Diameter Information for -N, -B, -W and -VBB Filters



Unmounted Filter Diameter	Diameter Tolerance	Mounted Filter Diameter $\pm 0.005''$	Unmounted Filter Thickness	Mounted Thickness	Clear Aperture
0.5" (12.7mm)	+0.00"/-0.005" (0.127mm)	0.625" (15.88mm)	2mm	0.300" (7.62mm)	0.450" (11.43mm)
1.0" (25.4mm)	+0.00"/-0.005" (0.127mm)	1.200" (30.48mm)	2.5mm	0.375" (9.53mm)	0.800" (20.32mm)
2.0" (50.8mm)	+0.00"/-0.005" (0.127mm)	2.225" (56.52mm)	4mm	0.500" (12.7mm)	1.900" (48.26mm)

NOTE: Filters are supplied open-faced unless otherwise specified

\* 2.0" Diameter 122-157nm filters are 5mm thick

## Filter Material Information

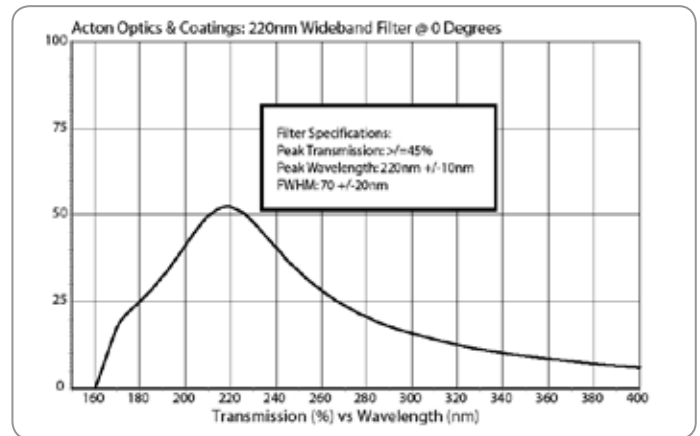
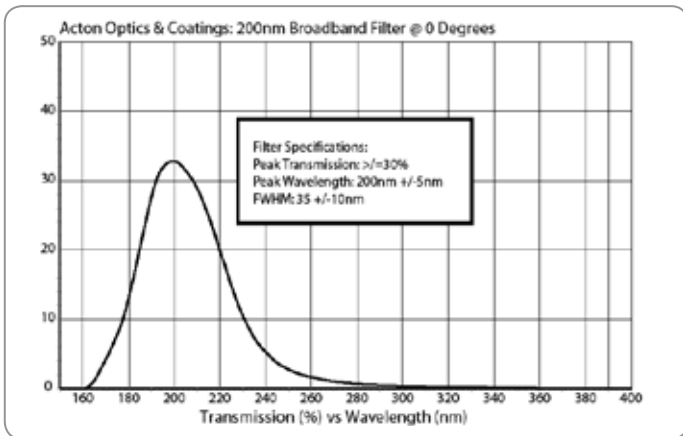
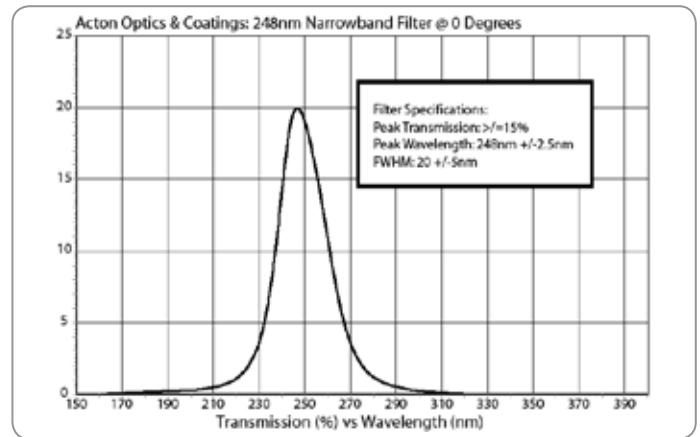
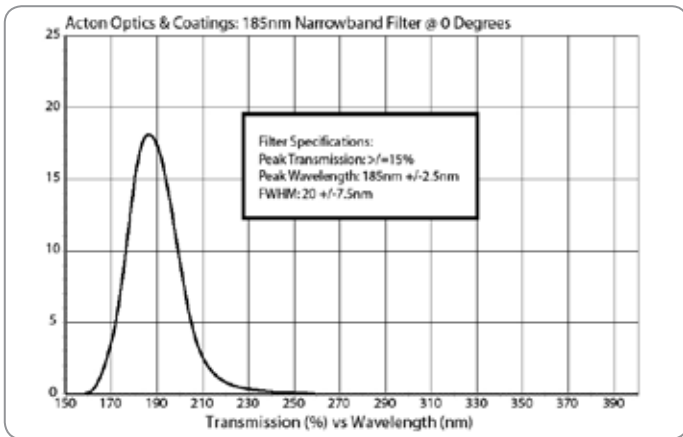
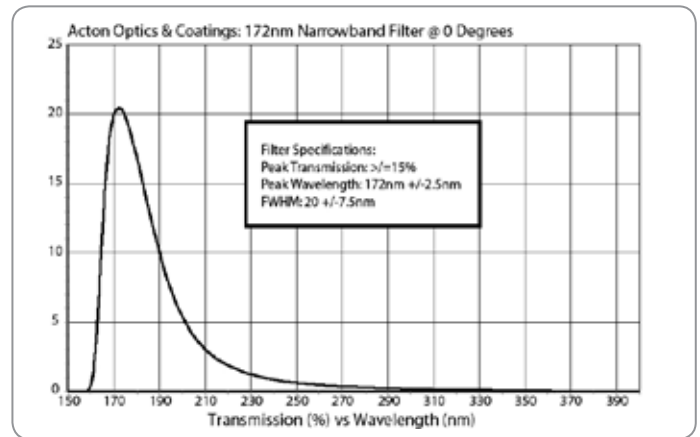
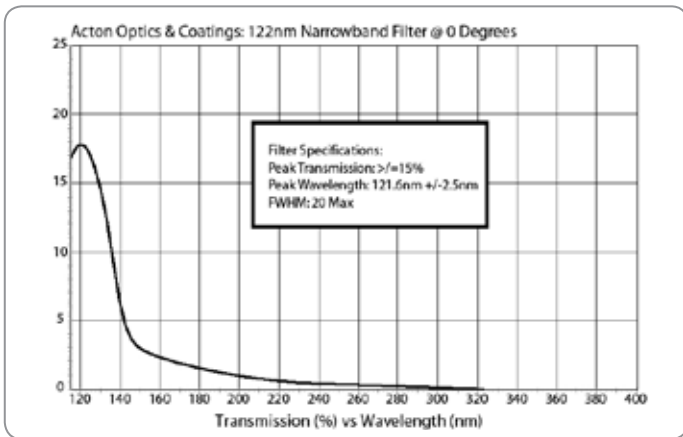
Wavelengths  
Substrate Material

120-150nm  
VUV MgF<sub>2</sub>

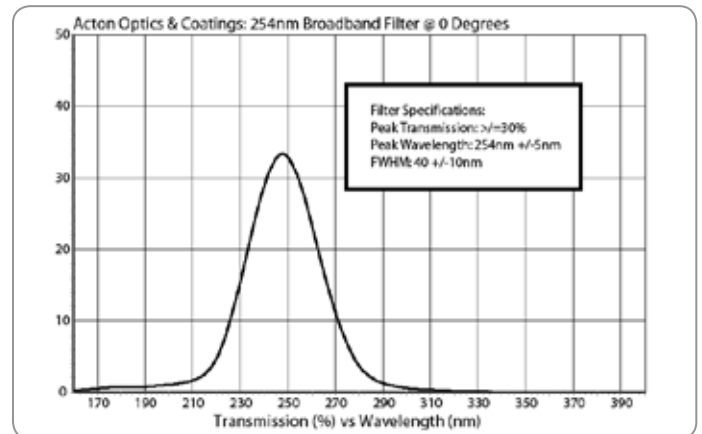
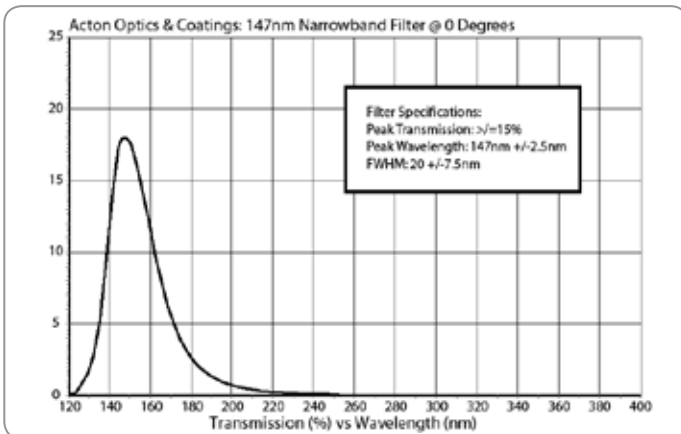
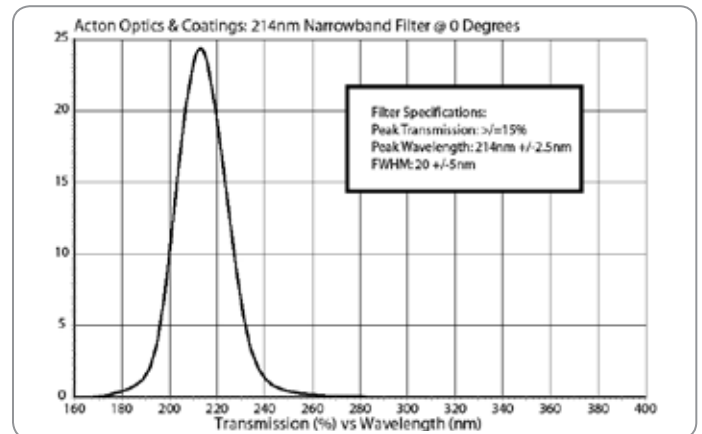
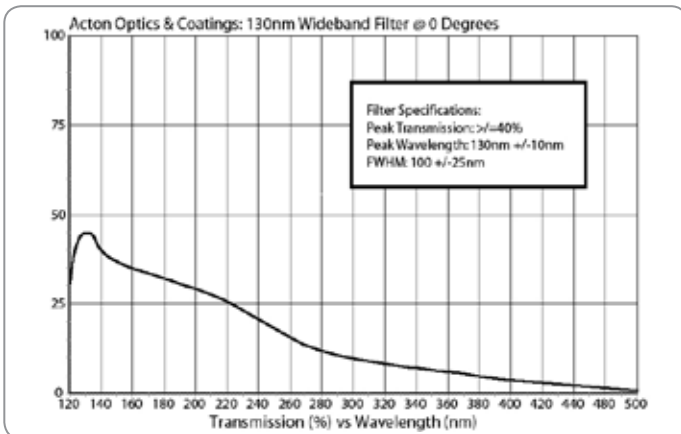
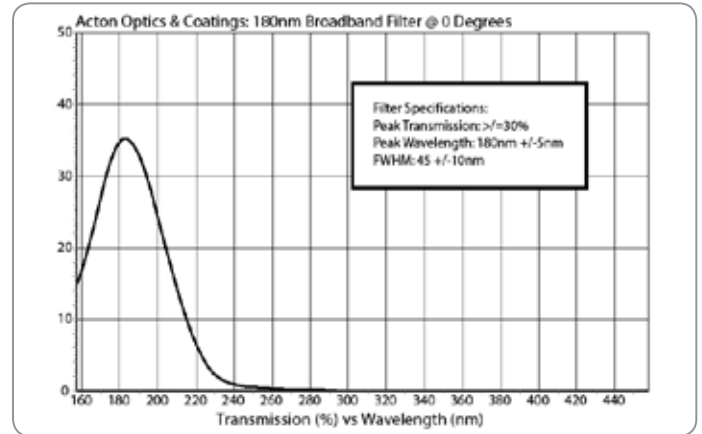
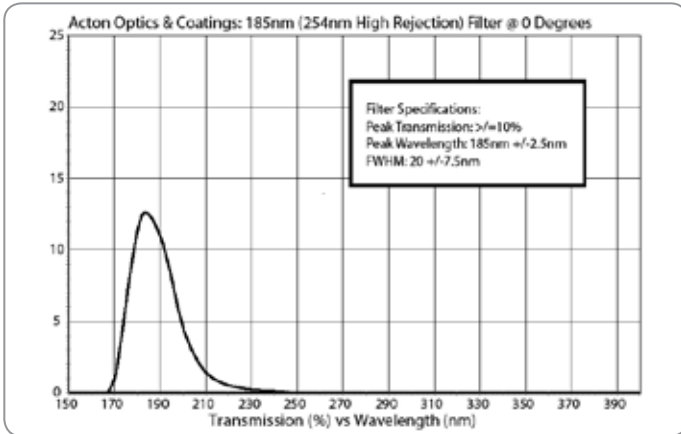
157nm  
VUV CaF<sub>2</sub>

170-320nm  
UV Grade Fused Silica

# Narrow, Broad and Wideband Filters



# Narrow, Broad and Wideband Filters



# UV Bandpass Filters

## Narrowband Filter Specifications/Part Numbers



Peak Wavelength (nm)	FWHM (nm)	Min. Peak Transmission	0.5" Diameter 2mm Thick	1.0" Diameter 2.5mm Thick	2.0" Diameter 4mm thick
122 +/-2.5nm	10 max.	5%	FN122-XN-.5D	FN122-XN-1D	FN122-XN-2D
122 +/-2.5nm	15 max.	10%	FN122-VN-.5D	FN122-VN-1D	FN122-VN-1D
122 +/-2.5nm	20 max.	15%	FN122-N-.5D	FN122-N-1D	FN122-N-2D
126 +/-2.5nm	20 +/-5	15%	FN126-N-.5D	FN126-N-1D	FN126-N-2D
130 +/-2.5nm	20 +/-5	15%	FN130-N-.5D	FN130-N-1D	FN130-N-2D
135 +/-2.5nm	20 +/-7.5	15%	FN135-N-.5D	FN135-N-1D	FN135-N-2D
140 +/-2.5nm	20 +/-5	15%	FN140-N-.5D	FN140-N-1D	FN140-N-2D
147 +/-2.5nm	20 +/-7.5	15%	FN147-N-.5D	FN147-N-1D	FN147-N-2D
150 +/-2.5nm	20 +/-5	15%	FN150-N-.5D	FN150-N-1D	FN150-N-2D
155 +/-2.5nm	20 +/-5	12%	FN155-N-.5D	FN155-N-1D	FN155-N-2D
157 +/-2.5nm	20 +/-5	12%	FN157-N-.5D	FN157-N-1D	FN157-N-2D
160 +/-2.5nm	20 +/-7.5	12%	FN160-N-.5D	FN160-N-1D	FN160-N-2D
172 +/-2.5nm	20 +/-7.5	15%	FN172-N-.5D	FN172-N-1D	FN172-N-2D
180 +/-2.5nm	20 +/-7.5	15%	FN180-N-.5D	FN180-N-1D	FN180-N-2D
185 +/-2.5nm	20 +/-7.5	15%	FN185-N-.5D	FN185-N-1D	FN185-N-2D
185 +/-2.5nm	20 +/-7.5	10%	FN185-HR-.5D	FN185-HR-1D	FN185-HR-2D
190 +/-2.5nm	20 +/-5	15%	FN190-N-.5D	FN190-N-1D	FN190-N-2D
193 +/-2.5nm	20 +/-5	15%	FN193-N-.5D	FN193-N-1D	FN193-N-2D
200 +/-2.5nm	20 +/-5	15%	FN200-N-.5D	FN200-N-1D	FN200-N-2D
205 +/-2.5nm	20 +/-5	15%	FN205-N-.5D	FN205-N-1D	FN205-N-2D
210 +/-2.5nm	20 +/-5	15%	FN210-N-.5D	FN210-N-1D	FN210-N-2D
214 +/-2.5nm	20 +/-5	15%	FN214-N-.5D	FN214-N-1D	FN214-N-2D
220 +/-2.5nm	20 +/-5	15%	FN220-N-.5D	FN220-N-1D	FN220-N-2D
222 +/-2.5nm	20 +/-5	15%	FN222-N-.5D	FN222-N-1D	FN222-N-2D
230 +/-2.5nm	20 +/-5	15%	FN230-N-.5D	FN230-N-1D	FN230-N-2D
240 +/-2.5nm	20 +/-5	15%	FN240-N-.5D	FN240-N-1D	FN240-N-2D
250 +/-2.5nm	20 +/-5	15%	FN250-N-.5D	FN250-N-1D	FN250-N-2D
254 +/-2.5nm	20 +/-5	15%	FN254-N-.5D	FN254-N-1D	FN254-N-2D

# UV Bandpass Filters

## Broadband and Wideband Filter Specifications/Part Numbers



Peak Wavelength (nm) <i>Broadband</i>	FWHM (nm)	Min. Peak Transmission	0.5" Diameter 2mm Thick	1.0" Diameter 2.5mm Thick	2.0" Diameter 4mm thick
130 +/-5nm	40 +/-10	30%	FB130-B-.5D	FB130-B-1D	FB130-B-2D
140 +/-5nm	60 +/-10	30%	FB140-B-.5D	FB140-B-1D	FB140-B-2D
150 +/-5nm	60 +/-10	30%	FB150-B-.5D	FB150-B-1D	FB150-B-2D
180 +/-5nm	40 +/-10	30%	FB180-B-.5D	FB180-B-1D	FB180-B-2D
190 +/-5nm	35 +/-10	30%	FB190-B-.5D	FB190-B-1D	FB190-B-2D
200 +/-5nm	35 +/-10	30%	FB200-B-.5D	FB200-B-1D	FB200-B-2D
210 +/-5nm	35 +/-10	30%	FB210-B-.5D	FB210-B-1D	FB210-B-2D
214 +/-5nm	35 +/-10	30%	FB214-B-.5D	FB214-B-1D	FB214-B-2D
220 +/-5nm	35 +/-10	30%	FB220-B-.5D	FB220-B-1D	FB220-B-2D
230 +/-5nm	35 +/-10	30%	FB230-B-.5D	FB230-B-1D	FB230-B-2D
240 +/-5nm	35 +/-10	30%	FB240-B-.5D	FB240-B-1D	FB240-B-2D
250 +/-5nm	40 +/-10	30%	FB250-B-.5D	FB250-B-1D	FB250-B-2D
254 +/-5nm	40 +/-10	30%	FB254-B-.5D	FB254-B-1D	FB254-B-2D

Peak Wavelength (nm) <i>Wideband</i>	FWHM (nm)	Min. Peak Transmission	0.5" Diameter 2mm Thick	1.0" Diameter 2.5mm Thick	2.0" Diameter 4mm thick
130+/-10nm	100 +/-25	40%	FW130-W-.5D	FW130-W-1D	FW130-W-2D
160 +/-10nm	100 +/-25	45%	FW160-W-.5D	FW160-W-1D	FW160-W-2D
200 +/-10nm	60 +/-20	45%	FW200-W-.5D	FW200-W-1D	FW200-W-2D
250 +/-10nm	80 +/-20	45%	FW250-W-.5D	FW250-W-1D	FW250-W-2D
300 +/-10nm	100 +/-25	45%	FW300-W-.5D	FW300-W-1D	FW300-W-2D

*Filters are available for all wavelengths up to 320nm. Specifications for FWHM, peak transmission and peak wavelength fall within peak wavelength ranges listed above.*

# UV Filters

## Solar Blind Filters

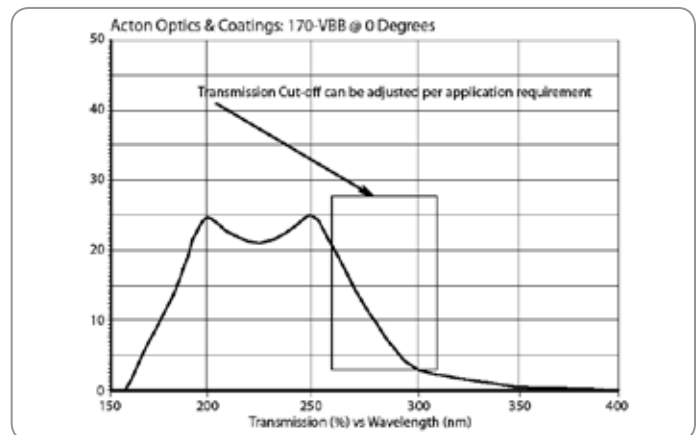
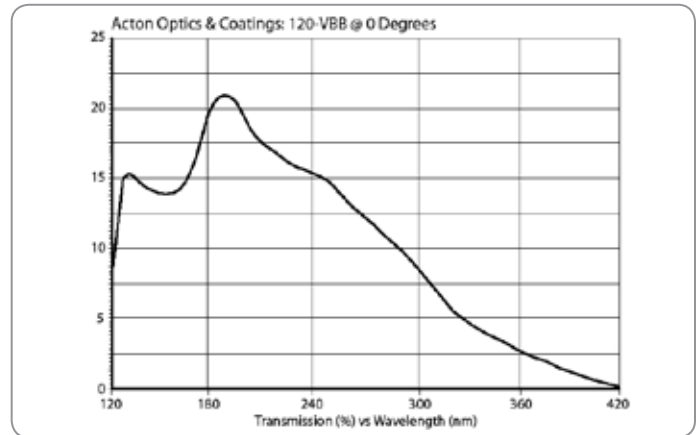
Originally designed for the space program, these unique very broadband UV and VUV filters are useful for isolating broad bands of UV or UV-VUV radiation. Our very broadband (VBB) filters offer broadband transmittance properties, averaging 10-20% over the bands specified. Rejection is approximately  $5 \times 10^{-3}$  at 500nm.

Care must be taken to avoid contact with the coated surface of this open-faced design, as absorption of the substrate at wavelengths near 120nm typically prohibits covering and edge sealing. Model 170-VBB is manufactured open-faced, however it can be supplied covered and edge sealed to protect the coated surface. See page 21 for more information.

Model 120-VBB: Average transmission 10-20% from 120-250nm

Model 170-VBB: Average transmission 10-20% from 170-300nm

Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.



## Solar Blind Filters on Acton Standard Filter Substrates



Wavelength Range	Average Transmission	0.5" Part Numbers	1.0" Part Numbers	2.0" Part Numbers
120-250nm	10-20%	FB120-VBB-0.5D	FB120-VBB-1D	FB120-VBB-2D
170-300nm	10-20%	FB170-VBB-0.5D	FB170-VBB-1D	FB170-VBB-2D

NOTE: Substrate material for part number FB120-VBB, UV-Grade MgF<sub>2</sub> and Fused Silica for FB170-VBB

# UV Filters

## VUV/UV Beamsplitters

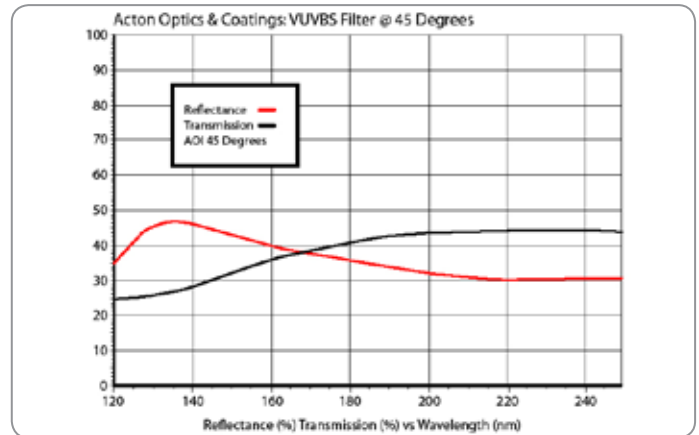
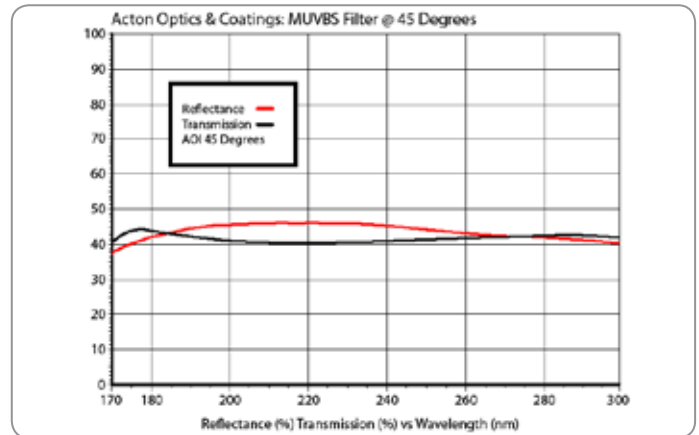
Acton offers two types of broadband metallic beamsplitter coatings. Beamsplitters are designed for 45° angle of incidence and Acton Optics can provide S&P polarization information based on simulations and actual data.

**MVUVBS45:** Vacuum UV beamsplitter transmittance & reflectance of 32-42% average from 120-240nm at 45°.

**MMUVBS45:** Middle UV beamsplitter transmittance & reflectance of 40-50% average from 170-320nm at 45°.

These beamsplitters are designed for low power applications in the wavelength ranges 120-300nm.

*Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.*



## VUV/UV Beamsplitters on Acton Standard Filter Substrates



Wavelength Range	Average Transmission	0.5" Part Numbers	1.0" Part Numbers	2.0" Part Numbers
120-240nm	32-42%	MVUVBS45-.5D	MVUVBS45-1D	MVUVBS45-2D
170-300nm	40-50%	MMUVBS45-.5D	MMUVBS45-1D	MMUVBS45-2D

NOTE: Substrate material for part number MVUVBS45, UV Grade MgF<sub>2</sub> and Fused Silica for MMUVBS45

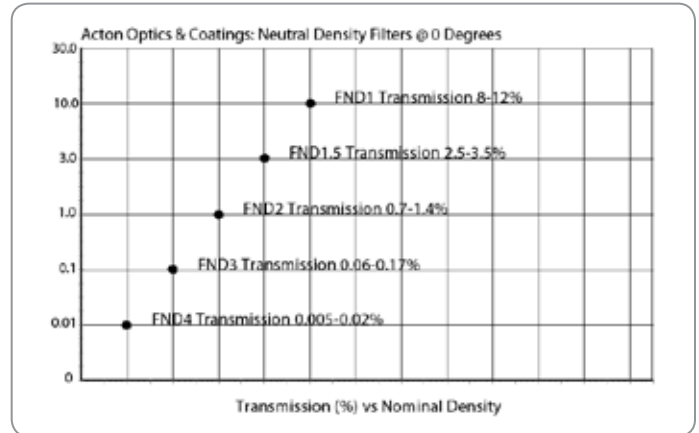
# VUV Filters

## Neutral Density

Acton Optics & Coatings' vacuum ultraviolet neutral density filters are made of metallic films, over-coated with a dielectric protective layer. Density over the range of 120-200nm is determined by the combined transmittance, reflectance and absorption of these films. Acton also offers this line of neutral density filters for the UV wavelength range of 200-320nm.

Each filter is individually calibrated for transmittance over range of 120-200nm and supplied with a transmittance curve. VUV ND5 and ND6 filters are offered as special order items. They are calibrated at strong VUV spectral lines only, such as 160.8nm and 253.7nm. VUV neutral density filters are coated on UV-grade MgF<sub>2</sub> and UV neutral density filters are provided on UV-grade fused silica.

VUV and UV neutral density filters can be supplied in anodized metal rings as described on page 21.



*Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.*

## VUV Neutral Density Filters



Optical Density	Nominal Transmission	Transmission Range	0.5" Part Numbers	1.0" Part Numbers
0.3	50%	42-58%	FND0.3-.5D-V	FND0.3-1D-V
0.5	30%	25-35%	FND0.5-.5D-V	FND0.5-1D-V
1.0	10%	8-12%	FND1-.5D-V	FND1-1D-V
1.5	3.0%	2.5-3.5%	FND1.5-.5D-V	FND1.5-1D-V
2.0	1.0%	0.7-1.4%	FND2-.5D-V	FND2-1D-V
3.0	0.1%	0.06-0.17%	FND3-.5D-V	FND3-1D-V
4.0	0.01%	0.005-0.02%	FND4-.5D-V	FND4-1D-V
5.0	0.001%	0.0007-0.0015%	FND5-.5D-V	FND5-1D-V
6.0	0.0001%	0.00007-0.00014%	FND6-.5D-V	FND6-1D-V

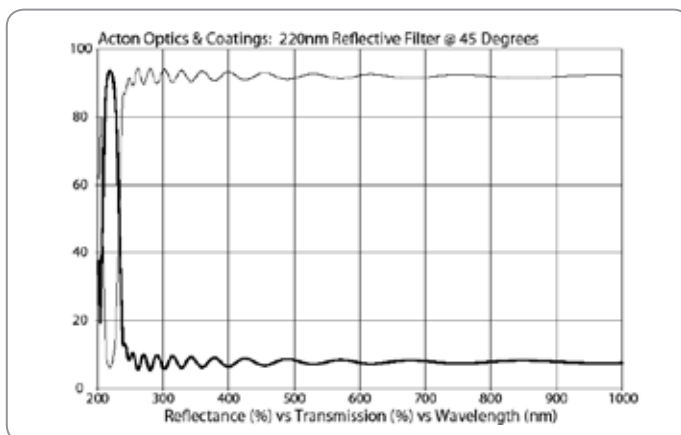
NOTE: Substrate material for all VUV ND Filters is MgF<sub>2</sub> and Fused Silica for all UV ND Filters

# UV/VUV Filters

## 45° Reflective Filters

Multi-layer reflective filters are all-dielectric reflectors that offer high reflectance at specific VUV through UV wavelengths while transmitting longer wavelength UV to IR light. Refer to page 32-33. "VUV-UV Grade Windows" table for specifications. Custom UV filters for peak wavelengths >250nm are available with deep UV - vacuum UV transmittance below ~210nm. Contact the Optics Sales Department for custom coatings and ordering information.

Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.



## UV/VUV Reflective Filters on Acton Standard Filter Substrates



Wavelength	Peak Reflectance	1.0" Part Numbers	1.5" Part Numbers	2.0" Part Numbers
126nm	≥ 40%	M126-3045-1D	M126-3045-1.5D	M126-3045-2D
146nm	≥ 45%	M146-3045-1D	M146-3045-1.5D	M146-3045-2D
157nm	≥ 82%	M157-3045-1D	M157-3045-1.5D	M157-3045-2D
172nm	≥ 82%	M172-3045-1D	M172-3045-1.5D	M172-3045-2D
185nm	≥ 82%	M185-3045-1D	M185-3045-1.5D	M185-3045-2D
193nm	≥ 82%	M193-3045-1D	M193-3045-1.5D	M193-3045-2D
200nm	≥ 90%	M200-3045-1D	M200-3045-1.5D	M200-3045-2D
208nm	≥ 90%	M208-3045-1D	M208-3045-1.5D	M208-3045-2D
212nm	≥ 90%	M212-3045-1D	M212-3045-1.5D	M212-3045-2D
220nm	≥ 90%	M220-3045-1D	M220-3045-1.5D	M220-3045-2D
240nm	≥ 90%	M240-3045-1D	M240-3045-1.5D	M240-3045-2D
248nm	≥ 90%	M248-3045-1D	M248-3045-1.5D	M248-3045-2D
254nm	≥ 90%	M254-3045-1D	M254-3045-1.5D	M254-3045-2D
260nm	≥ 90%	M260-3045-1D	M260-3045-1.5D	M260-3045-2D
266nm	≥ 90%	M266-3045-1D	M266-3045-1.5D	M266-3045-2D
280nm	≥ 90%	M280-3045-1D	M280-3045-1.5D	M280-3045-2D
300nm	≥ 90%	M300-3045-1D	M300-3045-1.5D	M300-3045-2D
320nm	≥ 90%	M320-3045-1D	M320-3045-1.5D	M320-3045-2D
340nm	≥ 90%	M340-3045-1D	M340-3045-1.5D	M340-3045-2D
352nm	≥ 90%	M352-3045-1D	M352-3045-1.5D	M352-3045-2D
360nm	≥ 90%	M360-3045-1D	M360-3045-1.5D	M360-3045-2D

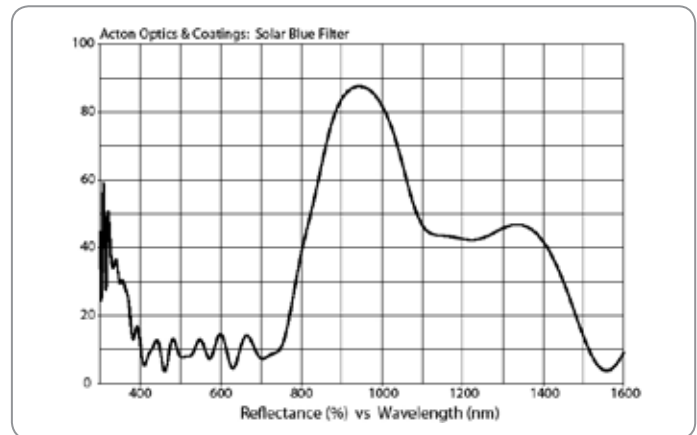
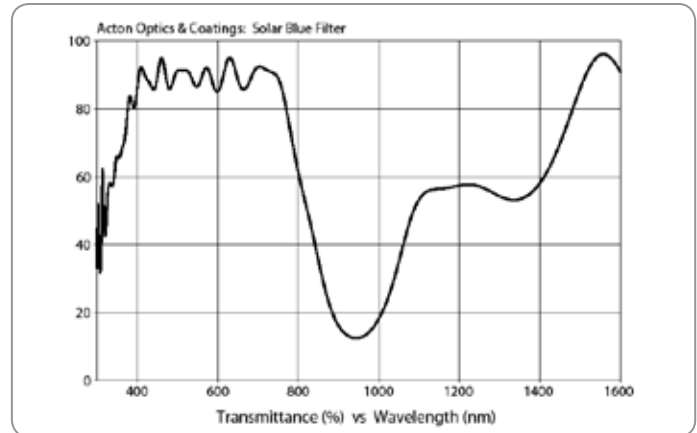
NOTE: Substrate material for filters below 175nm is CaF<sub>2</sub> and Fused Silica above 175nm

# Solar Filters

## Solar Blue Filters

Acton's custom designed Solar Blue filters provide excellent solar spectrum matching for solar simulator applications. Acton Optics & Coatings can custom design a filter to match your specific light source output. By matching the output to the solar spectrum, the efficiency of the solar simulator application is increased.

*Coatings can be applied to Acton standard substrates (pgs: 32-33), custom substrates and customer supplied material (CSM). Please contact Acton Optics & Coatings for details.*



# Lumogen E Coatings

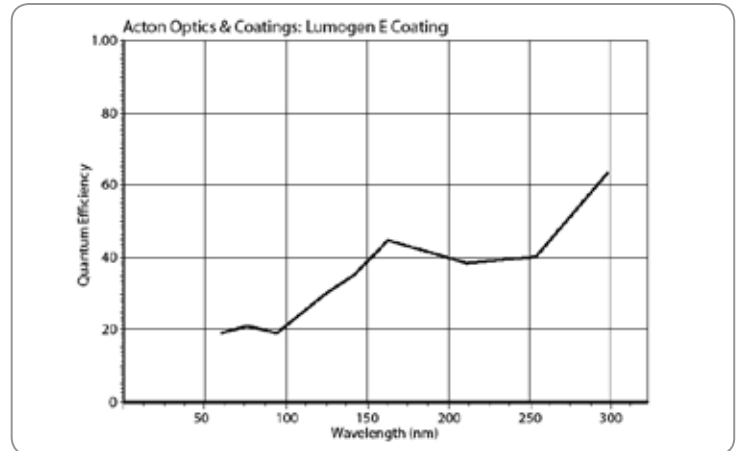
## CCD Enhancement

Lumogen E is a composite phosphor coating that improves the sensitivity of CCDs in blue-visible and ultraviolet (UV) wavelengths. The application of a thin coating of Lumogen E to the surface of a CCD effectively, reliably, and inexpensively achieves a dramatic increase in device sensitivity in the 120 to 430-nm range. Both front-illuminated and back-illuminated CCDs will achieve improved UV response using Lumogen E.

### Optical Properties

Lumogen E emits light at approximately 540 to 580 nm when excited with light below 450 nm. The high conversion efficiency of Lumogen E, combined with the high quantum efficiency of CCDs at the emission wavelength, make Lumogen E an ideal UV "down converter" for silicon detectors. Below 460 nm, the thin layer of Lumogen E becomes transparent and therefore has no detrimental effect on the quantum efficiency of a CCD in the visible and near-infrared.

The front-illuminated CCD has virtually no response below 350 nm and less than 5% quantum efficiency is typically observed at 400 nm (in the blue-visible range). With the Lumogen E coating, this same CCD exhibits 10% quantum efficiency below 350 nm. Back-illuminated CCDs also benefit from Lumogen E coating. Using the Lumogen E coating, the quantum efficiency improves by more than a factor of 10 at 250 nm. Lumogen E coating provides a superior alternative to the best broadband UV antireflection coatings on back-illuminated CCDs because performance in the red portion of the spectrum is less compromised.



Typical Quantum Efficiency of CCDs Coated with Lumogen E

### Spatial Resolution of CCDs coated with Lumogen E

We have performed measurements to determine the effects of Lumogen E coatings on spatial resolution. The contrast-transfer functions for a coated and uncoated CCD with a 20- $\mu\text{m}$  square pixel were compared and found to be identical.



# Standard Substrates

## Mirror Blanks and Filter Substrates

Acton substrates are made from select grades of the finest available optical materials. Mirror blanks are suitable for beam-steering requirements and front surface coatings. Filter substrates are qualified for transmission requirements down to 120nm. Mirror blanks and filter substrates are available with transmittance traces for an additional charge.



### Mirror Blanks

Part Number	Diameter	Thickness	Substrate Material
W.5D-MB	0.5" (12.7mm)	0.250" (6.35mm)	Corning 7980 0C or equivalent
W1D-MB	1.0" (25.4mm)	0.250" (6.35mm)	Corning 7980 0C or equivalent
W1.5D-MB	1.5" (38.1mm)	0.200" (5mm)	Corning 7980 0C or equivalent
W2D-MB	2.0" (50.8mm)	0.375" (9.53mm)	Corning 7980 0C or equivalent

### Filter Substrates

Part Number	Diameter	Thickness	Substrate Material
WFS-.5D (WCF-, WMF-)	0.5" (12.7mm)	0.079" (2mm)	UV Fused Silica, CaF <sub>2</sub> , MgF <sub>2</sub>
WFS-1D (WCF-, WMF-)	1.0" (25.4mm)	0.098" (2.5mm)	UV Fused Silica, CaF <sub>2</sub> , MgF <sub>2</sub>
WFS1.5D (WCF-, WMF-)	1.5" (38.1mm)	0.200" (5mm)	UV Fused Silica, CaF <sub>2</sub> , MgF <sub>2</sub>
WFS-2D (WCF-, WMF-)	2.0" (50.8mm)	0.157" (4mm)	UV Fused Silica, CaF <sub>2</sub> , MgF <sub>2</sub>

**NOTES:**

WFS= UV Fused Silica, WCF = CaF<sub>2</sub>, WMF = MgF<sub>2</sub> | 2" Diameter CaF<sub>2</sub> and MgF<sub>2</sub> Filter Substrates are 5mm Thick

### Specifications

Specifications	Mirror Blanks	Filter Substrates
<b>Material:</b>	UV Laser Grade Fused Silica	UV Grade Fused Silica, MgF <sub>2</sub> , CaF <sub>2</sub>
<b>Diameter Tolerance:</b>	+0.00/-0.005"	+0.00/-0.005"
<b>Thickness Tolerance:</b>	+/-0.25mm	+/-0.25mm
<b>Surface Figure:</b>	Side 1: 1/10 Wave @ 632.8nm	Both sides: <2 Waves @ 632.8nm
<b>Parallelism:</b>	3 arc min	3 arc min
<b>Scratch/Dig:</b>	20-10	20-10
<b>Chamfer:</b>	0.5mm x 45 degrees	0.5mm x 45 degrees
<b>Clear Aperture:</b>	Central 85%	Central 85%

# Standard Windows

## Laser Windows

Acton Optics & Coatings windows are made from select grades of the finest available optical materials. VUV/UV windows are suitable for a large range of VUV-UV applications. Flat laser windows are suitable for high power laser applications and as substrates for mirrors and beamsplitters. Excimer-grade  $\text{CaF}_2$  and  $\text{MgF}_2$  substrates are available for laser cavity optics and are available with transmittance traces for an additional charge.



### Fused Silica Laser Windows

Part Number	Diameter	Thickness	Substrate Material
W.5D-FL	0.5" (12.7mm)	0.250" (6.35mm)	Corning 7980 0C or equivalent
W1D-FL	1.0" (25.4mm)	0.250" (6.35mm)	Corning 7980 0C or equivalent
W1.5D-FL	1.5" (38.1mm)	0.200" (5mm)	Corning 7980 0C or equivalent
W2D-FL	2.0" (50.8mm)	0.375" (9.53mm)	Corning 7980 0C or equivalent

### Excimer-Grade $\text{CaF}_2$ and $\text{MgF}_2$ Laser Windows

Part Number	Diameter	Thickness	Substrate Material
W1D-FLC	1.0" (25.4mm)	0.250" (6.35mm)	Excimer-Grade $\text{CaF}_2$
W1.5D-FLC	1.5" (38.1mm)	0.200" (5mm)	Excimer-Grade $\text{CaF}_2$
W2D-FLC	2.0" (50.8mm)	0.375" (9.53mm)	Excimer-Grade $\text{CaF}_2$
W1D-FLM	1.0" (25.4mm)	0.250" (6.35mm)	Excimer-Grade $\text{MgF}_2$
W1.5D-FLM	1.5" (38.1mm)	0.200" (5mm)	Excimer-Grade $\text{MgF}_2$
W2D-FLM	2.0" (50.8mm)	0.375" (9.53mm)	Excimer-Grade $\text{MgF}_2$

### Specifications

Specifications	Fused Silica Laser Windows	$\text{CaF}_2$ , $\text{MgF}_2$ Excimer Laser Windows
<b>Material:</b>	UV Laser-Grade Fused Silica	Excimer-Grade $\text{CaF}_2$ , $\text{MgF}_2$
<b>Diameter Tolerance:</b>	+0.00/-0.005"	+0.00/-0.005"
<b>Thickness Tolerance:</b>	+/-0.25mm	+/-0.25mm
<b>Surface Figure:</b>	Both sides 1/10 Wave @ 632.8nm	Both sides: 1/10 Wave @ 632.8nm
<b>Parallelism:</b>	3 arc min	3 arc min
<b>Scratch/Dig:</b>	20-10	20-10
<b>Chamfer:</b>	0.5mm x 45 degrees	0.5mm x 45 degrees
<b>Clear Aperture:</b>	Central 85%	Central 85%

*Acton Optics & Coatings can supply custom optics for your OEM applications.*

# Optical Subassemblies

## Precision Mounted Optical Components

Our numerous years of experience producing precision aligned opto-mechanical and electro-optical assemblies used in commercial and research-grade instrumentation qualifies Acton Optics & Coatings to provide the best solution for your application needs. Our quality system ensures consistent, high quality products. All of our optical subassemblies are produced in our class 10,000 clean room, which has available class 100 conditions under laminar flow benches.



## Benefits

**Build to Print**

**< 3 arc min Alignment**

**Batch-to-Batch Consistency**

## Applications

**Medical Laser**

**Semiconductor**

**Analytical**

**Industrial**

**Aerospace**



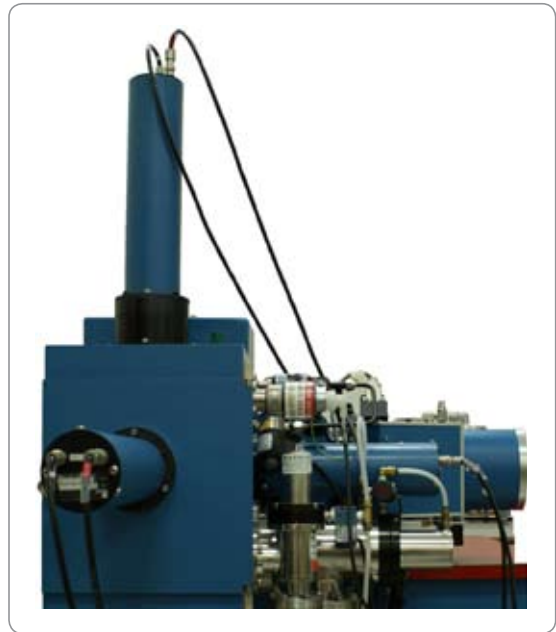
# Optical Metrology

## VUV-UV Measurement Services

Acton Optics & Coatings offers precise reflectance and transmittance measurement services for catalog components and customer supplied samples. Measurements are performed using vacuum and atmospheric spectrophotometers including our in-house, custom manufactured and designed Acton CAMS VUV/UV automated measurement systems.

Our CAMS-507 DUV provides precise reflectance, absorption, and transmittance measurements in the 120 to 1100 nm wavelength range, from 0° to 70° and reflectance measurements from 15° to 70°. A vacuum system is used to remove the air from the light path in order to allow transmission of deep UV wavelengths. Optics can also be tested in a dry nitrogen environment.

The CAMS system is configured with a high resolution 0.75 meter focal length vacuum monochromator, focused deuterium light source (with output from 115- 300nm), a large sample chamber with hinged vacuum tight access door, detectors and vacuum pumping system. Additionally, our SpectraSense software enables full presentation and analysis of your data with optional Excel® format for exporting into data processing software.



## Measurement Specifications

### Capabilities

- Atmospheric Transmittance and Reflectance from 200nm-1100nm
- Vacuum Transmittance or Reflectance from 120nm-600nm

### Angles (dependent on sample size)

- Near normal incidence (15°) up to 70° for vacuum reflectance
- Normal incidence (0°) up to 60° for atmospheric and vacuum transmittance

### Typical Samples

- Crystals: LiF, MgF<sub>2</sub>, CaF<sub>2</sub>, BaF<sub>2</sub>, Sapphire
- Fused Silica / Quartz
- Mirrors • Optical Filters

### Sizes

- From 0.5" to 3.0" diameter or 2.0" square (accommodations for other sizes are available for additional charge)
- PL/PL Samples should be provided for accurate measurements



# Optics Handling Note

## Care and Use of Vacuum UV Coatings

### Care and Use of Vacuum UV Coatings

Vacuum UV (VUV) coatings of Al + MgF<sub>2</sub> are relatively soft and care must be taken to avoid damage from contamination of the optical surfaces. Stains and fingerprints are extremely difficult to remove without damaging the coating. Dust and dirt can usually be removed by careful flushing of the surface with high-purity Asahiklin AK-225 (see note at bottom of page) from a clean polyethylene squeeze bottle (Figure 1). Starting at the top of the surface to be cleaned, squirt the above mentioned cleaning liquid onto the optical surface in a back-and-forth horizontal sweeping motion. Work slowly to the bottom of the surface. Any droplets remaining at the lower edge of the device after rinsing may contain contaminants and should be gently blotted with absorbent tissue without touching the coated surface. NEVER brush or wipe the coated surface.

If the optic is to be used in a vacuum application, the normal contamination process that takes place in VUV instruments can be minimized by not allowing radiation to strike the optical coating until the vacuum in the system has reached the 10<sup>-5</sup> torr range or below (never above 10<sup>-4</sup> torr). Since deterioration of the optical surface is a function of flux density and time, light sources should be illuminated only when necessary to obtain reliable data.

Accidental contamination in a vacuum instrument can be a more serious problem, usually indicated by a severe reflectance loss in two wavelength bands centered around 130 nm and 190 nm. Extreme caution should be exercised to avoid high pressures in the chamber while the light source is in operation. This is clearly a danger during windowless light-source operation.

**To summarize, these precautions should be taken to extend the useful life of VUV coatings:**

Use extreme care when handling coated optics. Rinse with a recommended cleaning solution. Never wipe the coated surface.

Light sources should be illuminated only when necessary to collect data and only at the minimum power level needed to obtain reliable data.

The light source should never be turned on until vacuum has reached the 10<sup>-5</sup> torr range or below.

The system should be operated windowless only when necessary and with extreme caution.

Care should be taken to avoid backstreaming of pump oils onto the optical surfaces.

The use of zeolite traps is advised in the roughing line and between the light source and mechanical pump used for the lamp gas system.

If coated optics are removed from the system for storage, a suitable cover should be used that contacts only the outer edges and storage should be in a clean dry atmosphere

**Optics should be examined periodically and cleaned only if absolutely necessary.** Stripping and re-coating of seriously contaminated optics can be considered if cleaning is not successful. Contact the Optics Sales Department for more information.

Note: Vertrel XF is a registered trademark of Dupont, Inc., and is available from Miller-Stephenson Chemical Company, Inc., Fairfield County, CT, tel. 800-992-2424. Asahiklin - AK-225 is a product of Asahi Glass Co. Ltd., and is available from Tech-Spray Corp., Amarillo, TX, tel. 806-372-8523.



# Optics Handling Note

## Care and Use of UV Laser Mirrors



**Figure 1.** Flushing the optic with Vertrel XF or Asahiklin AK-225.



**Figure 2.** Blotting the lower edge of device without contacting the coated surface.



**Figure 3.** An alcohol-saturated cotton ball can be used to gently pat the surface.

Note: Vertrel XF is a registered trademark of Dupont, Inc., and is available from Miller-Stephenson Chemical Company, Inc., Fairfield County, CT, tel. 800-992-2424. Asahiklin AK-225 is a product of Asahi Glass Co. Ltd., and is available from Tech-Spray Corp., Amarillo, TX, tel. 806-372-8523.

Care and Use of UV Laser Mirrors Dielectric laser coatings can be handled, cleaned, and stored with care according to the following procedures. Care should be taken to avoid any stains and fingerprints on the coated area of the optic. The original covers supplied with the optic are designed for shipment and storage and should be saved.

Unless the mirror is stained, it is rarely necessary to touch the coating. For general removal of light dust, a small clean air syringe is recommended. A stream of filtered pre-purified dry nitrogen can also be used.

If dust particles have a static charge, they can be difficult to remove with air. A clean polyethylene squeeze bottle containing high-purity Vertrel XF® (see note at bottom of page) or Asahiklin AK-225 (see note at bottom of page) can be used (Figure 1).

Starting at the top of the surface to be cleaned, squirt the abovementioned cleaning liquid onto the optical surface in a back-and-forth horizontal sweeping motion. Work slowly to the bottom of the surface. Any droplets remaining at the lower edge of the device after rinsing may contain contaminants and should be gently blotted with absorbent tissue without touching the coated surface (Figure 2). NEVER brush or wipe the coated surface.

If the surface becomes stained, first attempt the above steps. If this is not successful, careful washing of the coated surface can be done with a soft cotton ball soaked in pure alcohol (electronic-grade isopropanol). The procedure is to first flush the entire coated surface with alcohol, then gently pat with an alcohol-saturated cotton ball (Figure 3). Without allowing the alcohol to evaporate, immediately rinse with alcohol and Vertrel XF or Asahiklin AK-225 as described above. Any droplets remaining at the lower edge of the device after rinsing should be gently blotted with absorbent tissue without touching the coated surface (Figure 2).

If the coated optic is removed from the apparatus for storage, the original covers should be used. For best results, store in a clean dry atmosphere.



# Ordering & Warranty

## Placing Orders

Please use Acton Optics & Coatings part numbers when placing orders whenever possible.

## Telephone Orders

Place from 7:30AM to 5:00PM EST at 978-263-3584. Please be specific with all details to avoid unnecessary delay.

## Fax Orders

Place at 978-263-5086 with written confirmations by mail. Please include complete name and address with these orders to avoid confusion. Submit all written orders to our mailing address below. Orders are accepted subject to current prices.

## Mail orders to:

Acton Optics & Coatings, Division of Princeton Instruments  
15 Discovery Way • Acton, MA 01720 USA

## Customer Supplied Materials (CSM)

Customer Supplied Material (CSM) to be coated or measured must have an authorization number (CSM#) listed on the outside of the box and referenced on all documentation accompanying the shipment. Please contact Acton Optics & Coatings to acquire an authorization number.

## Ship Customer Supplied Materials to:

Acton Optics & Coatings, Div. of Princeton Instruments  
15 Discovery Way • Acton, MA 01720 USA

Attention: CSM# \_\_\_\_\_

NOTE: All Material Safety Data Sheets (MSDS) must accompany shipments where applicable.

## Terms:

Shipping Point: Acton, Massachusetts USA FOB: Acton, Massachusetts USA

## Payment Terms:

Established Accounts: Net 30 days

MasterCard & VISA also accepted for purchases

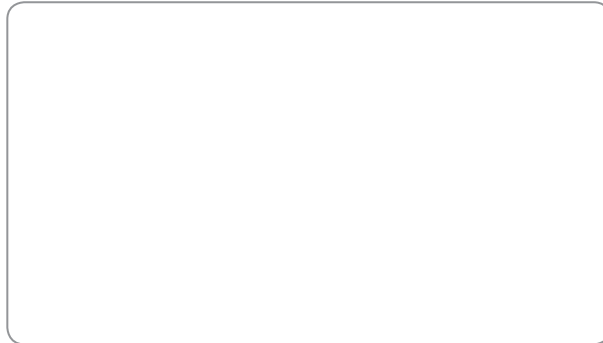
Non-Established Accounts: Normally net 30 days upon approval of credit references. Otherwise COD, prepaid or Letter of Credit / CAD.



# Ordering & Warranty

## Foreign Inquiries and Orders

Acton Optics & Coatings is represented around the world by various organizations. Contact Acton directly or visit our website [www.actonoptics.com](http://www.actonoptics.com) for referral to the representative in your country.



## Shipping

UPS (Ground, Blue or Red services), Federal Express, DHL, and air freight are available. UPS ground service will be used unless the buyer notes otherwise. Special handling charges may be added if appropriate. It is the buyers responsibility to report any shipping errors or damage in shipment within fifteen (15) days after delivery (must have original packing material).

## Returns

A restocking fee of 20% will be charged on all standard catalog optics accepted by Acton Optics for return to stock. All returns must be labeled on the outside of the package with a Return Material Authorization Number (RMA#) issued by Acton Optics. Specially designed optics or coatings, or products damaged by the customer may not be returned.

## Limited Warranty

Acton Optics optical components are warranted to perform within published specifications and against defects in workmanship or materials. This warranty does not cover products which were, as determined solely by Acton Optics & Coatings, improperly handled, cleaned or stored. Customers must notify Acton of any non-conformity within thirty (30) days of receipt of materials. All returns must be labeled on the outside of the package with a Return Material Authorization Number (RMA#) issued by Acton Optics & Coatings.

There are no warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose, except as provided herein. Liability of Acton Optics & Coatings shall be limited to the price paid and in no event shall Acton Optics be liable for lost profit or any other special or consequential damage.

Every effort has been made to provide the most accurate specifications in this catalog. However, Acton Optics & Coatings reserves the right to alter specifications at any time, if necessary.

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[www.actonoptics.com](http://www.actonoptics.com)

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