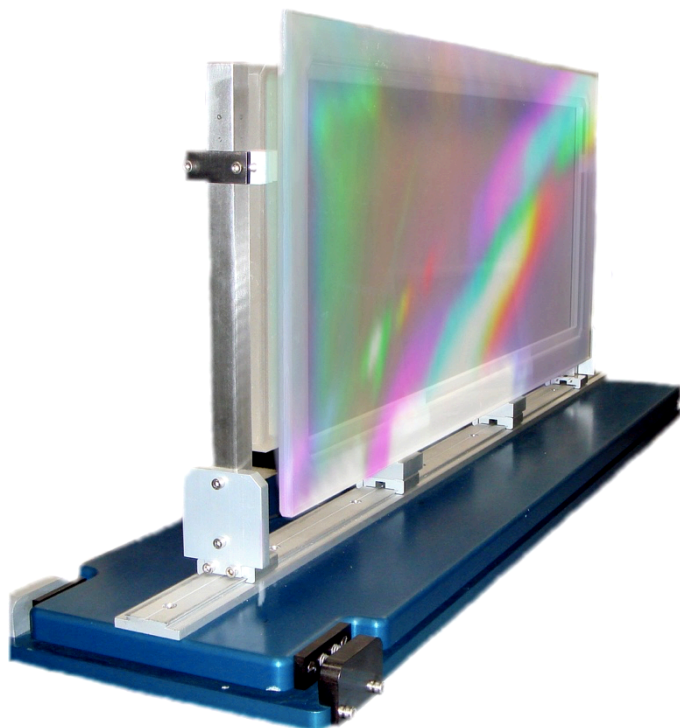


Aperture Optical Sciences, Inc. and Okamoto Optics (Yokohama, Japan) have collaborated to provide a full range of optics manufacturing capability. Aperture Optical Sciences Inc. provides aspheric optics manufacturing and other specialty optics for ITAR restricted projects in its Connecticut facility and also provides fast-turn manufacturing of prototypes and developmental optics for its US customers. Okamoto Optics provides an advanced commercial production facility serving worldwide customers in the scientific, semiconductor, aerospace, and medical sectors. Together we provide our customers with comprehensive manufacturing solutions.

Laser Optics

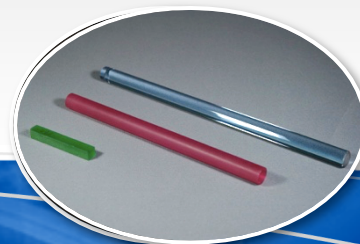
Making optics with high laser damage threshold requires a comprehensive approach to process design and control. As metrology is integral to process design we've invested into both R&D and special equipment to provide our customers with unique capabilities. Some of our unique capabilities derive from a strategic relationship with Okamoto Optics Works of Yokohama Japan and Plymouth Grating Laboratory. Special resources available at Okamoto Optics include a 3.5m polishing machine and a 2-meter electron beam coating chamber with IAD. Special metrology tools include a 700-mm aperture phase measuring interferometer, Zygo NewView 6000 white light interferometric microscope. Through our

partners at Plymouth Grating Laboratory we also have access to large aperture interferometry at 1053-nm, and SEM. We augment these special capabilities at AOS, with aspheric optics manufacturing and systems design and integration. Our experience along with our equipment have enabled us to develop processes which both optimize laser damage threshold while also controlling film stress and wavefront quality. This is critical to producing optics that maintain wavefront stability and film integrity in vacuum environments.



Specs and Options

Flatness	Up to $\lambda/100$ rms*
Diameter	10mm - 1100 mm
Surface Quality	10/5 & better
Coating	HR, AR, B/S, Polarizers for $\lambda = 351-1550$
Materials	Glass, & Glass Ceramics, F.S, Nd- Phosphate, HAP, YCOB, BBO, LBO
Custom Designs	Call for specifications and availability
Damage Threshold	See reverse*



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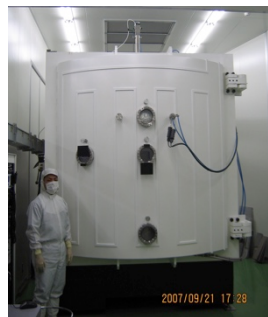
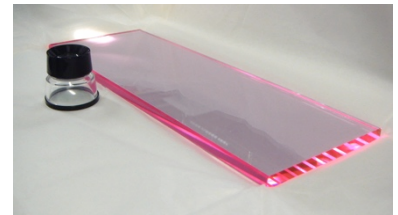
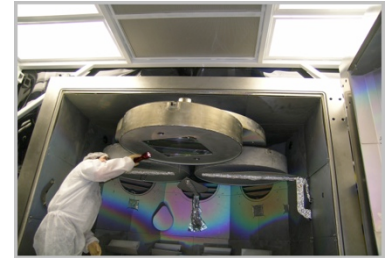
High Laser Damage Threshold Optics & Coatings



Damage Threshold: Our coatings have been tested by Osaka University Institute of Laser Engineering, SPICA, Sandia National Laboratory, Laboratory for Applied Optics (France), Ohio State University, and CEA. A summary of the damage thresholds we have satisfied to are shown in the table below.

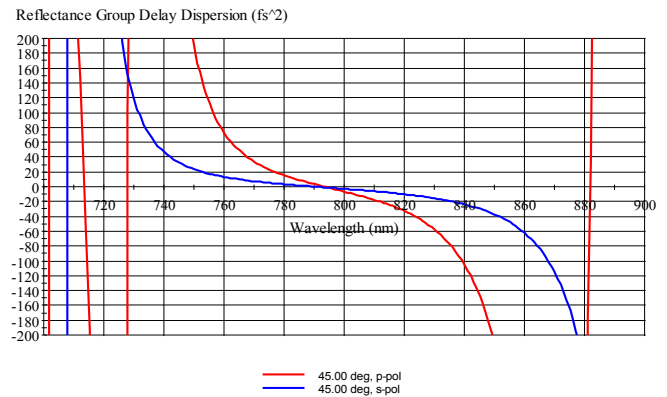
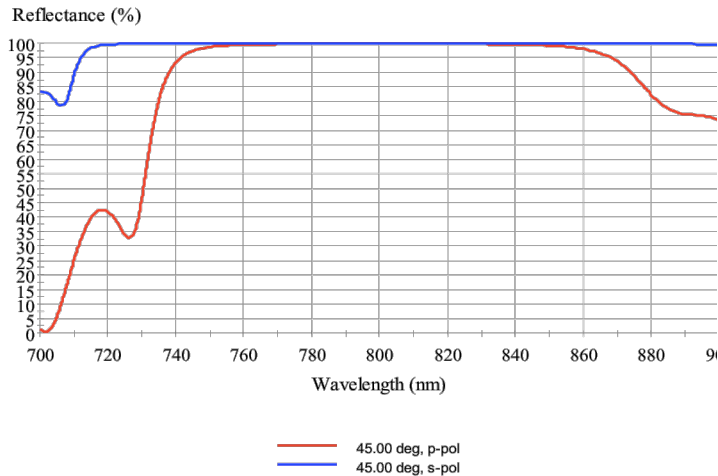
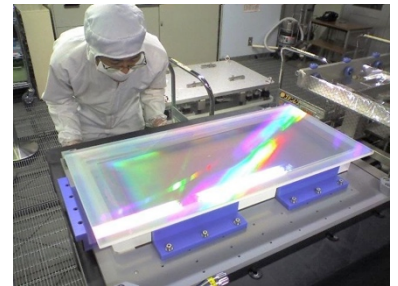
$\lambda = 1064 \text{ nm}$			LDT J/cm ² , S= 200:1			
	R	MATERIAL	1ns	3.5ns	10ns	20ns
HR @ 0°	> 99.5%	FS, BK7	63	118	200****	282
HR @ 45°	> 99.5%	FS, BK7	26	50**	84	119
HR @ 72°	> 99.5%	FS, BK7	16	30*	50	71
AR @ 0°	< 0.2 - 0.4%	FS, BK7	pending	pending	pending	pending
AR @ 45°	< 0.2 - 0.4%	FS, BK7	pending	pending	pending	pending
AR @ 57°	< 0.2 - 0.4%	FS, BK7	pending	pending	pending	pending
			LDT J/cm ²			
			480 fs @ 10Hz			
HR @ 72°	> 99.5%	FS	> 5***			

* = Tested by LLNL *** = Tested by CEA Blue = scaled value
 ** = Tested by SPICA **** = Tested by Osaka ILE Black = Measured value



Coatings are available for 526-nm, 1054-nm and broadband coatings for center wavelengths at either 800 or 900 nm. Our OOW-HRV-800-45 design provides nearly 200-nm of bandwidth. This coating name indicates a high reflector (for vacuum use) centered at 800-nm and optimized for an incident angle of 45 degrees. This coating design satisfies a specification of Rp or Rs > 99.9%.

We provide optics ranging in size from a few millimeters to more than 2-meters in size of all material types: glass, metal, ceramic, and specialty materials like SiC and sapphire. Design services, coatings, test services, assembly and systems development also available.



Aperture Optical Sciences, Inc. works in collaboration with Okamoto Optics of Yokohama Japan to create custom optics, optical instruments, and systems to customers worldwide. We also provide opto-mechanical design, applications engineering, and technology development services. Information on custom optics and extended services can be found at www.apertureos.com and www.okamoto-optics.com.

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