Optical Mirror Selection Guide

Mirrors are probably the most commonly used optical elements in your lab, and their quality, performance, and reliability are key to the success of your experiment. That’s why we provide a variety of mirrors so you can be assured to find what you need. When choosing an **Optical Mirror**, keep in mind the reflectivity, laser damage resistance, and coating durability. For quick delivery, all our mirrors are shipped from stock.

Metallic Coatings

Metal mirrors are good general-purpose mirrors because they can be used over a very broad spectral range from 450 nm to 12 µm. They are also insensitive to polarization and angle of incidence, and provide a constant phase shift, making them appropriate for ultrashort-pulse applications. Their softer coating, however, makes them more susceptible to damage, and special care must be taken when cleaning.

Dielectric Coatings

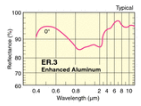
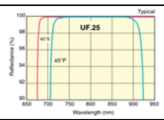
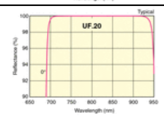
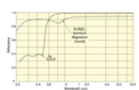
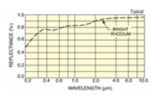
Dielectric mirrors offer higher reflectivity over a broad spectral range of a few 100 nm. Their coating is more durable, making them easier to clean, and more resistant to laser damage. We offer broadband dielectric mirrors that are ideal for general laboratory use as well as mirrors especially for high-power Nd:YAG applications at 1.064 µm and 532 nm and DUV and UV applications.

Ultrashort-Pulse Application Coatings

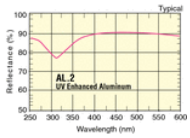
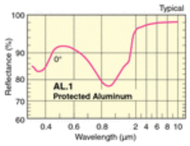
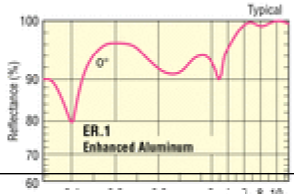
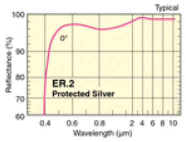
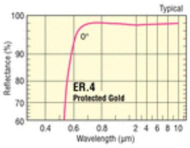
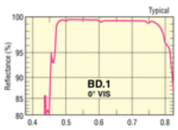
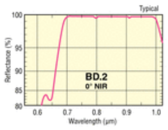
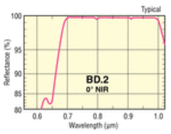
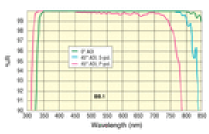
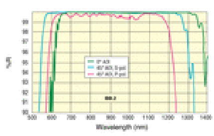
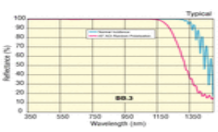
Dielectric mirror coatings can cause significant dispersive effects for ultrashort pulses. The dispersion of the material and the interference effects between the layers result in rapid phase variations at specific wavelengths. Since the group delay is related to the slope of the phase variation, these wavelength regions introduce significant group-delay errors that can broaden and distort your pulse. Therefore, for applications that require steering ultrashort pulses, such as those produced by Ti:Sapphire lasers, we suggest using our silver-coated mirrors, which have minimal phase distortion.

Selecting an Optical Mirror

Click **Optical Mirrors** to shop or browse all of our standard models, or select a product family below for more information. We also offer a wide variety of **Mirror Mounts**.

Metallic Coated Mirror Families		Coating Types	Diameters	Material	Clear Aperture
	Broadband Metallic Mirrors	AL.2 (250-600 nm) ER.1 (450-700 nm) ER.2 (480-20,000 nm) ER.4 (650-20,000 nm)	0.5 to 8.0 in.	Pyrex® or Zerodur®	≥central 80% of diameter
	Utility Broadband Metallic Mirrors		1.0 & 2.0 in. or Square	Float Glass	
	Concave Broadband Metallic Mirrors	AL.2 (250-600 nm) ER.1 (450-700 nm) ER.2 (480-20,000 nm)	0.5, 1.0 & 2.0 in.	Pyrex®	≥central 80% of diameter
	PinholeFree™ Broadband Metallic Mirrors	AL.2-PF (250-600 nm) ER.1-PF (450-700 nm) ER.2-PF (480-20,000 nm)	0.5, 1.0 & 2.0 in.	Pyrex®	≥central 80% of diameter
Dielectric Coated Mirror Families		Coating Types	Diameters	Material	Clear Aperture
	Broadband Dielectric Mirrors	BD.1 (488-694 nm) BD.2 (700-950 nm)	0.5 to 8.0 in.	Pyrex® or Zerodur®	≥central 80% of diameter
	Laser Line Dielectric Mirrors	Various Laser Lines	0.5 to 8.0 in.	Pyrex® or Zerodur®	≥central 80% of diameter
	Ultra-broadband Dielectric Mirrors	BB.1 (350-700 nm) BB.2 (650-1130 nm) BB.3 (350-1100 nm)	1.0 in.	UV Grade Fused Silica	≥central 80% of diameter
	High-Energy Nd:YAG Laser Mirrors	Various	1.0 & 2.0 in.	UV Grade Fused Silica	≥central 80% of diameter
	High-Energy Excimer Laser Mirrors	Various	1.0 & 2.0 in.	UV Grade Fused Silica	≥central 80% of diameter
	High Performance SuperMirrors™	SR.30F (583-663 nm) SR.40F (761-867 nm) SR.50F (996-1134 nm) SR.60F (1241-1412 nm) SR.70F (1457-1659 nm)	1.0 in.	UV Grade Fused Silica	
	Low GVD Broadband Mirror for Ultrashort Pulses		0.5, 1.0 & 2.0 in.	Grada A BK7	≥central 80% of diameter
	High Reflecting Pump Mirrors for Ultrashort Pulses		0.5 & 1.0 in.	Grada A BK7	≥central 80% of diameter
	Super-Broadband Turning Mirrors for Ultrashort Pulses	UF.35P (680-1060 nm) UF.35S (680-1060 nm)	1.0 in.	Fused Silica	≥central 78% of diameter
Parabolic and Ellipsoidal Mirror Families		Coating Types	Diameters	Material	Clear Aperture
	Off-Axis Replicated Parabolic Mirrors		1.5 in.	Alluminum	≥central 90% of diameter
	Ellipsoidal and Paraboloidal Reflectors			Electro Deposited Nickel	

Reflective Coatings

Metallic Coatings	Wavelength Range (nm)	Reflectance	Abrasion Resistance	Cost	Features
	250–600	R_{avg} >90%	Moderate	Low	UV Reflectivity is enhanced by a MgF_2 overcoat
	400–700	R_{avg} >88%	Moderate	Low	Visible reflectivity is enhanced by a protective SiO overcoat
	450–700	R_{avg} >93%	Moderate	Low	Visible and NIR reflectivity is enhanced by a multilayer dielectric overcoat
	0.48–20 µm	R_{avg} >96%	Moderate	Low	Visible and IR performance superior to aluminum coatings
	0.65–20 µm	R_{avg} >96%	Moderate	Low	NIR to Infrared performance slightly higher than protected silver
Dielectric Coatings	Wavelength Range (nm)	Reflectance	Abrasion Resistance	Cost	Features
	488–694	R_s, R_p >98–99%	High	Moderate	Very high reflectivity over a broad wavelength range
	700–950	R_s, R_p >98–99%	High	Moderate	Very high reflectivity over a broad wavelength range
	700–950	R_s, R_p >98–99%	High	Moderate	Very high reflectivity over a broad wavelength range
	350-700	R_s, R_p >99%	High	Moderate	Special coating design to withstand higher damage threshold
	650-1130	R_s, R_p >99%	High	Moderate	Special coating design to withstand higher damage threshold
	350-1100	R_s, R_p >99%	High	Moderate	Special coating design to withstand higher damage threshold

Substrate Materials

We chose Pyrex® material for our substrates because it offers a lower thermal-expansion coefficient than BK7 optical glass and polishes more easily than fused quartz. Because the Pyrex substrate has inhomogeneities in its refractive index, they mirrors are not suited for transmissive applications. We fine-grind the backside of the substrates to prevent inadvertent transmissions. All the edges are chamfered to avoid chipping during use. When high stability is critical, Zerodur® is the best choice for its zero thermal expansion. UV fused silica has a thermal expansion coefficient lower than Pyrex® but is more expensive. Because of its excellent transmissive properties, UV fused silica is often reserved for transmissive mirrors as well as high-energy laser mirrors.

Material	Coefficient of Thermal Expansion	Cost	Features
Pyrex®	3.25×10^{-6}/°C	Low	Best all around mirror substrate, low expansion borosilicate glass,resistant to thermal shock
UV Fused Silica	0.52×10^{-6}/°C	High	Low thermal expansion for excellent stability, high laser damage resistance
Zerodur®	$0 \pm 0.1 \times 10^{-6}$/°C	Moderate	Nominally zero thermal expansion for ultra-high stability, unique glass-ceramic material

Optical Surfaces

Surface Quality

The surface quality of an optic is described by its surface figure and irregularity. Surface figure is defined as peak-to-valley deviation from flatness, including any curvature (also known as power) present. Surface irregularity is represented by the peak-to-valley deviations when power is subtracted. Our front-surface figure is guaranteed flat to less than l/10 at 633 nm over the clear aperture. Our 2" mirrors have a figure of l/4 over the clear aperture. When preservation of wavefront is critical, choose a flatness of l/10 or better.
As for surface quality, the smaller the scratch-dig specification, the lower the scatter. Our metal mirrors offer a scratch-dig of 25-10; our dielectric mirrors, 15-5; and our UV mirrors, 10-5, which is ideal
for the most demanding laser systems where low scatter is critical.
dig: a defect on the surface of an optic as defined in average diameter in 1/100 of a millimeter.
scratch: a defect on an optic that is many times longer than it is wide.

Selecting the proper mirror for your application requires making a number of choices. A few of the many considerations include: reflectivity, laser damage resistance, coating durability, thermal expansion of the substrate, wavefront distortion, scattered light, and certainly cost. The following tables should help in comparing the available choices from Newport.

The mirror application drives the requirements for surface flatness and surface quality. When preservation of wavefront is critical, a $\lambda/10$ to $\lambda/20$ mirror should be selected; when wavefront is not as important as cost, a $\lambda/2$ to $\lambda/5$ mirror can be used. For surface quality, the tighter the scratch-dig specification, the lower the scatter. For demanding laser systems, 20-10 to 10-5 scratch-dig is best. For applications where low scatter is not as critical as cost, 40-20 to 60-40 scratch-dig can be used.

Surface Flatness

Figure	Cost	Applications
λ/2	Low	Used where wavefront distortion is not as important as cost
λ/5	Moderate	Excellent for most general laser and imaging applications where low wavefront performance must be balanced with cost
λ/10	Moderate	For laser and imaging applications where low wave front distortion, especially in systems with multiple elements
λ/20	High	For the most demanding laser systems where maintaining accurate wavefront is critical to performance

Surface Quality

Scratch-Dig	Cost	Applications
60-40	Low	Used for low-power laser and imaging applications with unfocused beams where scatter is not critical
40-20	Moderate	Ideal for laser and imaging applications with collimated beams where scatter begins to affect system performance
20-10	High	Excellent for laser systems with focused beams that can tolerate little scattered light
10-5	High	For the most demanding laser systems where low scatter is critical to performance