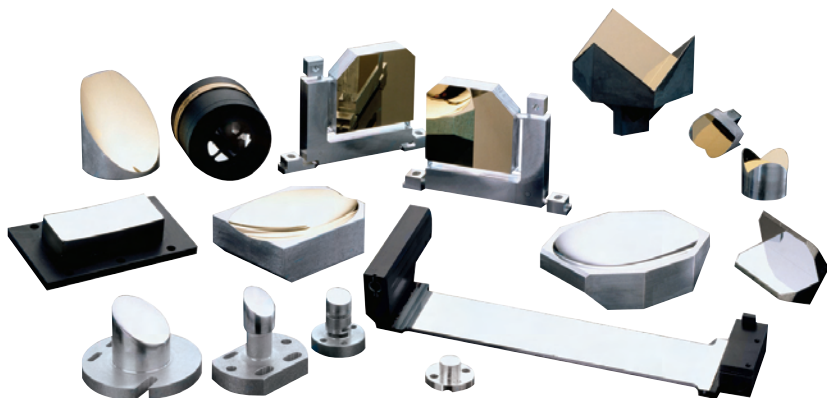


Replicated Mirrors Capabilities



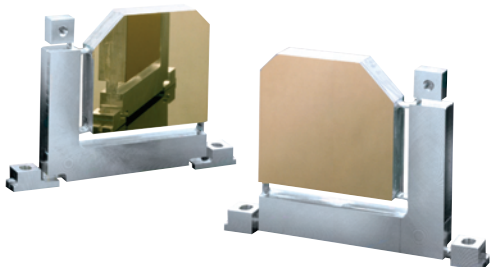
Features

- Low scatter for UV applications
- Integral mount
- Achromatic focusing and collimation
- Light-weight
- Multiple substrate options
- Built-in kinematic adjustment options
- Enhanced thermal stability
- UV-IR and NIR-IR coating options

Material Selection

Almost any material that epoxy will adhere to can be used as a replica substrate. However, the surface accuracy and stability of the mirror will depend completely on that choice of substrate material. We routinely fabricate replicated mirrors on the following substrates:

- Aluminum
- Beryllium
- Fused Silica
- Graphite Epoxy
- Aluminum Oxide
- Silicon
- Silicon Carbide
- Titanium
- Miralloy
- Stainless Steel



Since 1977, Newport Corporation has been providing discriminating applications specialists with superior replicated optical components which surpass functional performance expectations and provide maximized ease-of-use and minimum cost. From production quantity optics for OEM instrumentation to one-off aerospace programs, Newport's Opticon brand is recognized as an industry leader for custom high-precision replicated optics. Whether it's a simple, spherical, front-surface mirror in quantities of thousands per year or a one meter diameter aspheric mirror on a composite substrate, our unique combination of opto-mechanical engineering, manufacturing, and testing expertise ensure that the finished products will consistently meet all of the user's expectations. Our diverse manufacturing techniques allow smooth transition from prototype to production quantities. Total internal process control allows us to engineer solutions quickly in response to customers' changing requirements. The vast number of materials that we can work with and our extensive mechanical engineering skills allow effective adaptation of optics to existing instrument designs while improving fit, form, and function of the instrument itself.

The Benefits of Monolithic Structures

While Newport's replicated mirror business is capable of fabricating replicated mirrors onto conventional glass optics, our specialty lies in fabrication of metal, ceramic, or composite optics that can incorporate integral mounts, adjustments, and other features. By eliminating separate mounting structures and working with materials other than glass, optical systems can be made lighter, more thermally stable, and more rigid, while facilitating assembly and increasing repeatability. Our unique manufacturing processes allow substrate designs that would not otherwise be feasible, and mirror surfaces can be placed in locations that would otherwise be impossible.

Why and When to Replicate

Replicated optics can be used for both reflective and transmissive components. The main reasons for using replicated optics are to:

- Minimize system cost
- Produce light weight or low inertia optics
- Locate optical surfaces in otherwise inaccessible locations

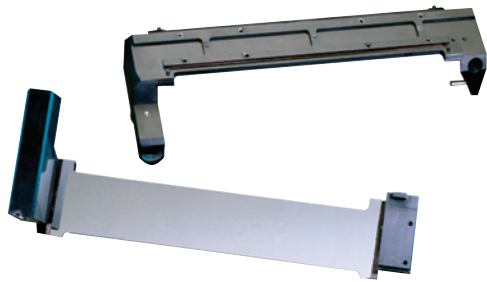
Metal replicated optics provide the ability to:

- Include the optical mount as part of the optical component
- Provide an accurate mounting surface aligned to the optical surface
- Permit a kinematic adjustment mechanism to be integral to the optical element
- Eliminate interfaces between the mirror and the mount that can go out of alignment under temperature excursions, vibration, and shock
- Have their temperature coefficient of expansion matched to the optical bench making the system less susceptible to ambient temperature changes

Lightweight and Low Inertia Optics

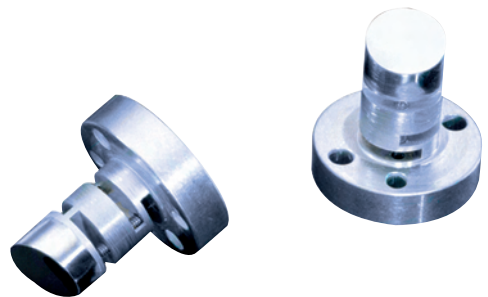
The density of the substrate is an important consideration when the weight of the replica is critical. The material's density must be considered in relation to its Young's modulus. A low density combined with a high Young's modulus yields minimum component weight and minimum inertia. Silicon carbide, Aluminum, and Beryllium are the best substrates for light-weight replicated mirrors.

When minimum inertia is the most important criteria for performance, the preferred substrate choices are Beryllium with a specific inertia of 6.65, followed by Boron carbide at 4.83, Miralloy at 4.49, and Silicon carbide at 3.5. For small size optics with minimum sheet thickness, density effects the choice of material. Beryllium provides the best option, followed by Aluminum.



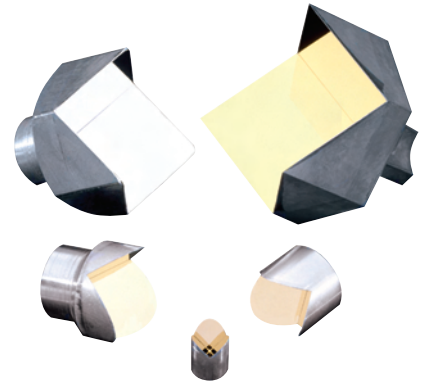
Aspheric Mirrors

Newport Corporation has extensive capabilities in the manufacture of aspheric mirrors. Typical optic configurations include on and off axis parabolics, ellipsoids, and toroids. High-accuracy aspheric elements can be produced in prototype through volume production quantities at a fraction of the cost associated with making similar products by conventional methods. Surfaces and coatings suitable for use in the deep UV through the far IR can be produced in virtually any accuracy, and substrates can incorporate integral mounts and kinematic adjustments if necessary. Many aspheric components can be designed to simply "bolt in place." With this type of optic / mount design, there is no additional alignment or adjustment necessary for assembly into the instrument.



Retroreflectors and Arrays

Truly monolithic individual hollow corner-cube and roof prisms offer bolt-in-place mounting, real thermal stability, and extreme resistance to shock and vibration, making them ideally suited for use in field applications, motion systems, and aerospace environments. Retroreflectors can be manufactured in virtually any shape substrate. Large elements up to 150mm in aperture are not uncommon. Arrays of multiple hollow prisms can be assembled and mounted in protective enclosures for long range sensing applications, and accuracies of the retros can be tailored to fit requirements of the application. Typical return beam accuracies range from 30 arc sec. for less demanding applications to 3 arc sec. for precision applications.



Flat and Spherical Mirrors

Although flat and spherical glass optics are widely available at relatively low costs, in many cases these types of optics are difficult and expensive to obtain in custom shapes, sizes, and materials. Focusing on the idea that improved fit, form, and function often constitute a better overall value, Newport Corporation offers the opportunity to upgrade components from standard off-the-shelf items to items that are specifically designed for an application, at costs that resemble those of the "standard" items.



Optics for Multi-Pass Cells

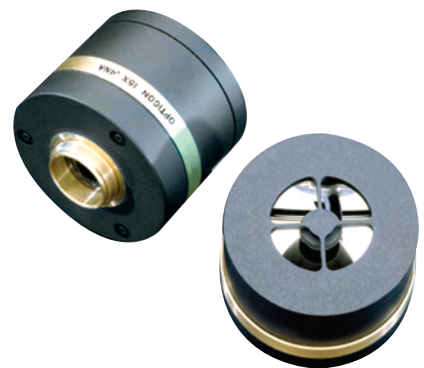
Many of the leading manufacturers of multi-pass cells for gas analysis turn to Newport Corporation for the fabrication of their optics. Our ability to provide multiple or "complex" mirror surfaces on a single substrate with repeatable, bolt-in-place alignment makes instrument assembly and field service an easy process. Special stainless steel mirrors allow cells to be used in extreme environments without the danger of adhesives breaking down at high temperature or under exposure to corrosives. Mirrors for White Cells, Herriott Cells, and even custom aspheric-based cell designs can be produced at very competitive prices.

Large Mirrors

Newport Corporation can produce replicated mirrors over 1 meter in diameter, even in production quantities. Mirror surfaces can be fabricated on materials such as aluminum, steel, glass, and ultra-lightweight composite materials. Flat, spherical, and aspheric surfaces are all possible and practical.

Telescopes, Microscope Objectives, and other Assemblies

In addition to fabricating individual components, Newport Corporation can provide complete optical assemblies, fabricated using replicated mirrors and other optical components. Custom reflective telescopes, microscope objectives, beam expanders, and "lateral transfer" devices can be manufactured, assembled, and tested at our facility. Designs can range from spherical-based to complex aspheric systems.

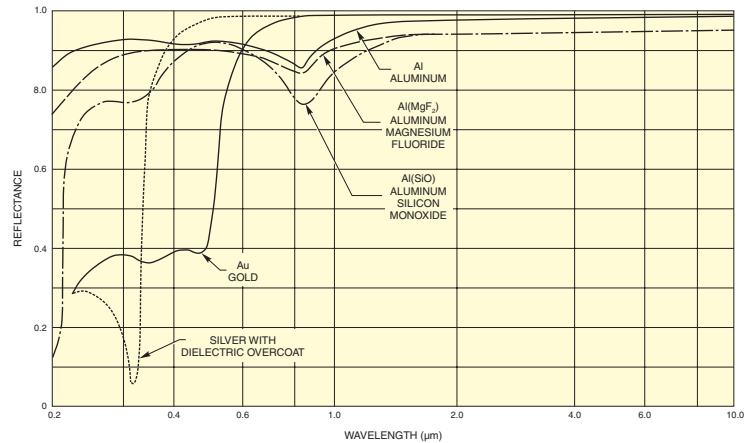


Custom & OEM Specification Capabilities

Spectral Range	250 nm to 15 μm
Reflectance	85% to 99% (dependent upon wavelength)
Coatings	Bare Aluminum, Bare Gold, Protected Aluminum, Protected Silver
Surface Quality	E/E (60/40) per MIL-F-48616 (typical); D/C (40/20) or C/B (20/10) achievable
Surface Roughness	25 \AA (typical)
Coating Adhesion	MIL-F-48616
Coating Hardness	Protected Aluminum & protected Silver coatings, only; MIL-F-48616 (modified to 0.5 lb.)
Operating Temperature Range	-80 $^{\circ}\text{F}$ to 160 $^{\circ}\text{F}$
Humidity Resistance	MIL-F-48616
Wavefront Distortion	$\lambda/2$ @ 633 nm (typical) [range from 2λ to $\lambda/8$]
Size Range	3 mm to 300mm (typical) [3 mm to 65 mm for Hollow Metal Retroreflectors]
Substrate Material	Aluminum, Aluminum Oxide, Beryllium, Fused Silica, Graphite Epoxy, Miralloy, Silicon, Silicon Carbide, Stainless Steel, Titanium [Aluminum and Stainless Steel for Hollow Metal Retroreflectors]

Specialized Measurement Capabilities

In addition to our capabilities for routine spectral, environmental, mechanical and optical inspection, we have designed and built an integrated measurement system consisting of a phase-shift interferometer coupled with a high-precision coordinate measurement machine. This instrument allows measurement of the relationship between the mounting surface of an optic and its optical surface, referred to as pointing accuracy, to within 0.00010".



Typical reflectance curves of metallic reflective coatings

Tell Us What You Need

We receive calls nearly every day from customers with exciting new applications. Newport Corporation is continually finding new ways to integrate our distinctive capabilities with our customers' ideas in order to help them realize the full potential of their design. There is no longer the need to design an application around optics that are already available. Newport Corporation offers you the ability to design the optics to meet your system requirements. Large or small, prototype or production; tell us what you need and we'll find a way to make it.



Replicated Mirrors Technical Sales - 508-528-4411 - mirrors.sales@newport.com



Newport Corporation, 1791 Deere Avenue, Irvine, CA 92606
Telephone: 800-222-6440, 949-863-3144, Facsimile: 949-253-1680, sales@newport.com
 Newport Corporation, Irvine, California, has been certified compliant with ISO 9001 by the British Standards Institution.

Belgium
 Telephone: +32-(0)16-402927
 Facsimile: +32-(0)16-402227

France
 Telephone: (0)1-60-91-68-68
 Facsimile: (0)1-60-91-68-69

Italy
 Telephone: +39-(0)2-92-90-921
 Facsimile: +39-(0)2-92-32-448

Taiwan
 Telephone: +886-(0)22-769-9769
 Facsimile: +886-(0)22-769-9638

Canada
 Telephone: 905-567-0390
 Facsimile: 905-567-0392

Germany
 Telephone: +49-(0)6151-708-0
 Facsimile: +49-(0)6151-708-952

Netherlands
 Telephone: +31-(0)715-79-1899
 Facsimile: +31-(0)715-79-1897

United Kingdom
 Telephone: +44-(0)11-635-521-757
 Facsimile: +44-(0)11-635-521-348

Visit Newport Online at www.newport.com

Printed in the USA