Plymouth Grating
LABORATORY

sales@plymouthgrating.com

Transmission Diffraction Gratings

Benefits

- Excellent Diffraction Efficiency
- Exceptional Diffracted Wavefront Error
- High Uniformity over the full aperture
- High Laser Damage Threshold
- Curved lines are possible for focusing applications

Typical Applications

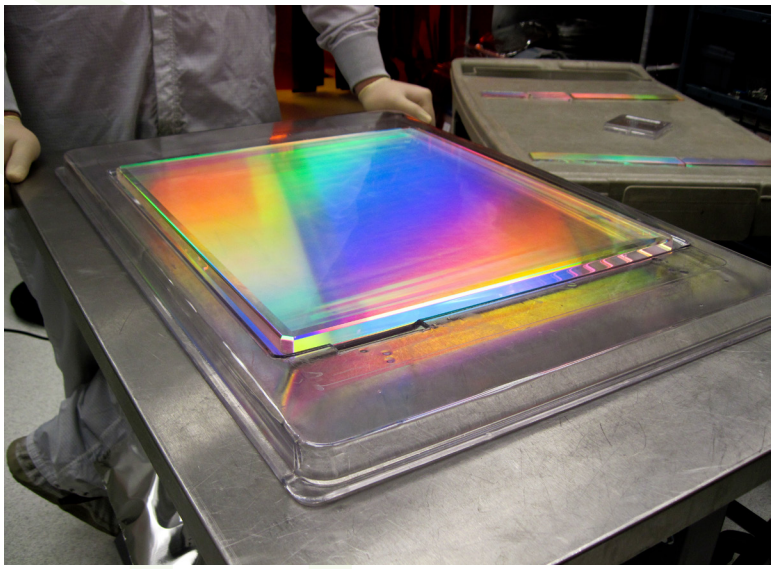
- Pulse compression especially for compact, commercial femtosecond lasers
- Spectral Beam Combining (SBC) for very high average power lasers
- High intensity spherical and cylindrical focusing elements for scientific lasers and industrial annealing applications

Features

Grating Type	Transmitting
Diffraction Efficiency	Typ. 93 – 96%
Wavefront Error	< λ/4 (depends on size)
Laser Damage Threshold	15 J/cm^2 @1054 nm, 10 ns
Bandwidth	Typ. 10's to > 100 nm

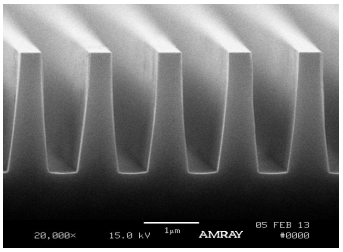
Transmission gratings require very deep groove depths to achieve high diffraction efficiency into the desired order – typically 3 – 10 times deeper than MLD and gold gratings. PGL has developed a deep etch process based on reactive ion etching (RIE) capable of attaining > 2.5 µm groove depths directly in fused silica substrates. The high uniformity of this process coupled with the precision of Scanning Beam Interference Lithography implemented in PGL's Nanoruler grating writing technology leads to exceptional Diffracted Wavefront Error performance.

Superior antireflection (AR) coatings are also critical for transmission gratings. PGL's experience in thin-film coating enables us to produce our own optimized AR coatings for each transmission grating design. The resulting gratings are ideal for compact, commercial systems from laser pulse compressors to spectrometers.

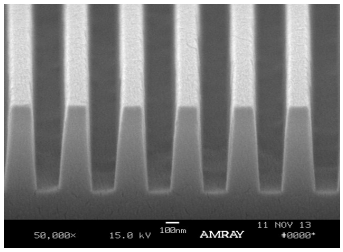


Product Details

PGL's grating exposure and etching processes produce exceptionally smooth, uniform, and deep grating grooves for negligible diffracted wavefront distortion and high uniformity and diffraction efficiency.

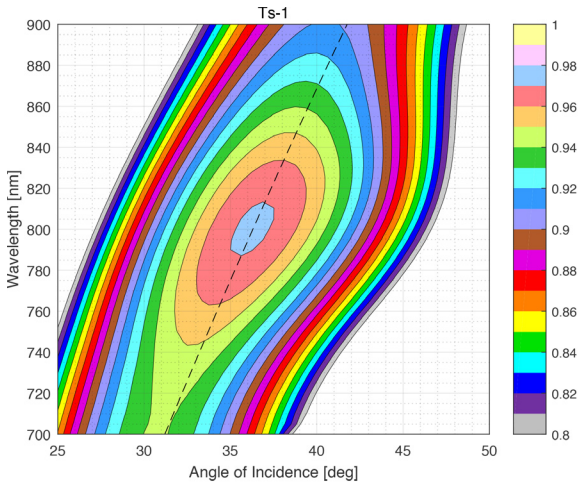


2.5 µm deep, 800 l/mm



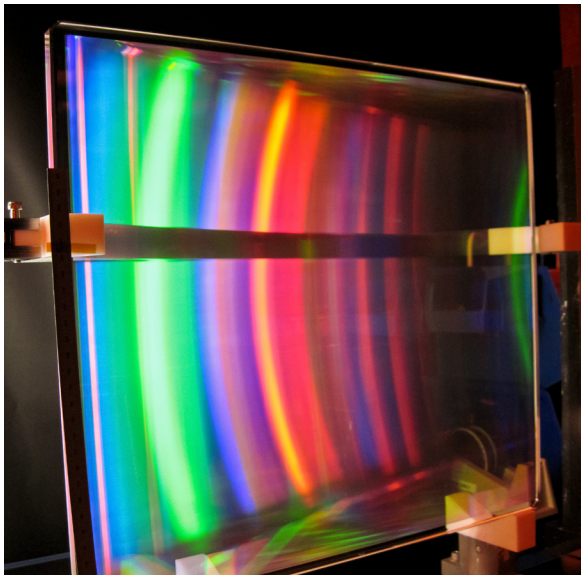
0.65 µm deep, 2,400 l/mm

The plot below shows the theoretical diffraction efficiency vs. input wavelength and angle of incidence for a 1,200 l/mm grating optimized for 800 nm. Actual gratings typically have DE 1 – 2% below theory.



Focusing Gratings

In addition to the many advantages of PGL's SBIL grating writing technology for standard gratings – high diffraction efficiency, consistent duty cycle, and period repeatability of 10 ppb from part-to-part – the Nanoruler also can readily produce curved grating lines. As a result, we can produce both spherically and cylindrically focusing gratings.



8 meter focal length spherical focusing grating for an ultrahigh-intensity UV laser system

Applications of this new and unique capability range from simplification (reduced element count) in ultrahigh-intensity laser installations to cylindrical focusing of excimer lasers for annealing systems, to lenses for laser-based free-space communications.

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Plymouth Grating Lab is dedicated to making the highest-quality diffraction gratings available today. Our focus is on lasers and laser systems. PGL gratings offer exceptionally high diffraction efficiency and laser damage threshold, combined with superior wavefront error and uniformity over large areas. This performance is made possible by PGL's exclusive use of the Nanoruler, based on the proprietary Scanning Beam Interference Lithography technology developed at MIT, and PGL's industry-leading process expertise. The company occupies 20,000 sq. ft. of dedicated manufacturing, engineering, and office space in Carver, MA, just outside of Plymouth, and about 45 miles south of Boston. For more information see plymouthgrating.com.