



Multilayer Dielectric (MLD) Diffraction Gratings

Benefits

- Excellent Diffraction Efficiency
- High Laser Damage Threshold
- Low Diffracted Wavefront Error
- No crazing in vacuum
- Good operating bandwidth

Typical Applications

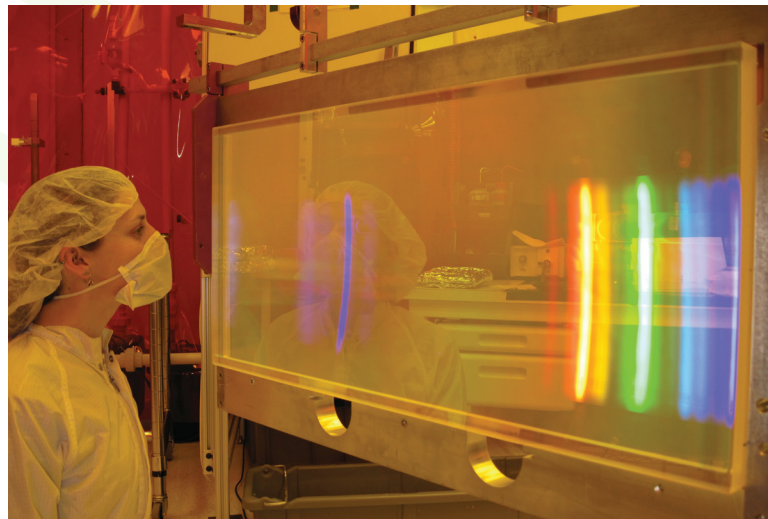
- Pulse compression in ultrahigh-intensity laser systems, especially those with moderate pulse widths (0.5 – 10 ps) and under high vacuum conditions
- Spectral Beam Combining (SBC) for very high average intensity lasers

Features

Grating Type	Reflecting
Diffraction Efficiency	Typ. 95 – 98%
Wavefront Error	$< \lambda/3$ (depends on size)
Laser Damage Threshold	2.5 J/cm ² @1054 nm, 10 ps
Bandwidth	Typ. 30 – 40 nm

PGL has been supplying MLD gratings to many of the world's largest ultrahigh-intensity laser installations for over a decade. The combination of thin-film coating with grating design and fabrication makes it possible to greatly improve diffraction efficiency, laser damage threshold, and wavefront of the compressed short pulse.

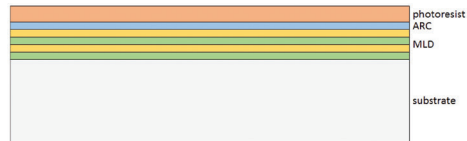
Gratings for pulse compression have very demanding requirements – in addition to severe flatness and damage threshold requirements, they must operate in high vacuum. With coatings of up to 40 layers in these conditions, coating stress must be carefully controlled, since too much compressive stress deforms the substrate while too much tensile stress causes “crazing.” PGL has developed a low-stress coating process for MLD gratings that achieves exceptional uniformity over very large areas and enables superior all-around performance under a wide range of operating conditions.



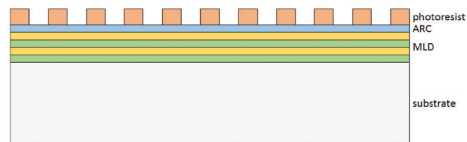
Inspection of a 910 mm × 420 mm pulse compression grating

Product Details

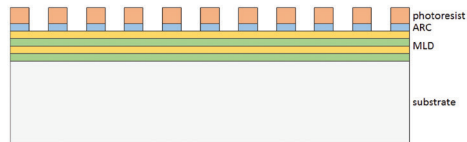
PGL has extensive expertise in grating manufacturing, as well as in thin-film optical coating, reactive-ion etching, optical metrology, and precision cleaning, inspection, and handling of large optics. All of these process areas are critical to high-performance MLD diffraction gratings.



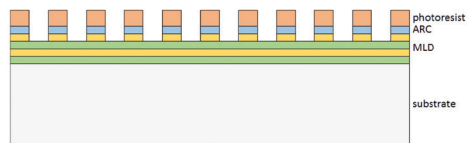
1) Coat substrate with MLD, ARC, photoresist



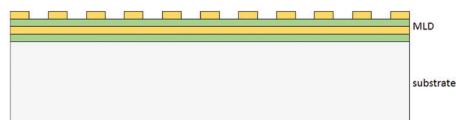
2) Pattern grating by SBIL and develop



3) Etch ARC by oxygen RIBE

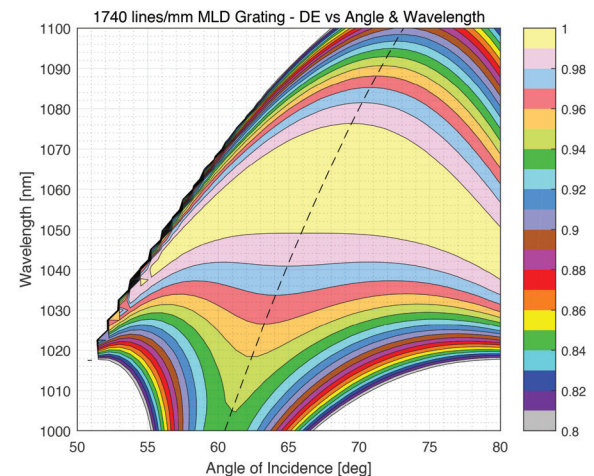
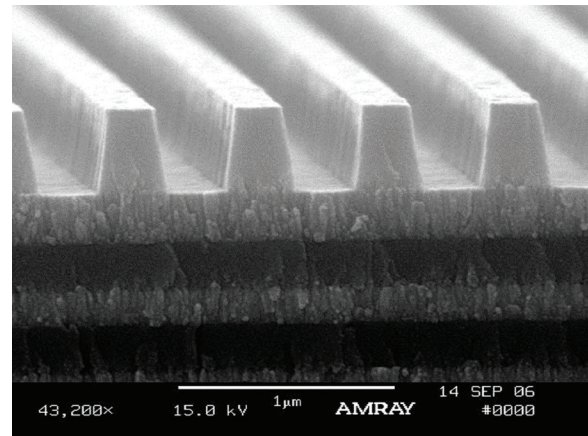


4) Etch MLD top layer by fluorine RIBE



5) Strip photoresist and ARC

PGL MLD gratings have demonstrated both high diffraction efficiency and high damage threshold. Our meter-class gratings consistently achieve > 96% diffraction efficiency in the 1st order, and LIDT is proven at both 600 fs and 10 ps – the results are among the highest ever demonstrated for MLD gratings.



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Plymouth Grating Laboratory 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.