

DIFFRACTIVE OPTICS

High Performance Gratings

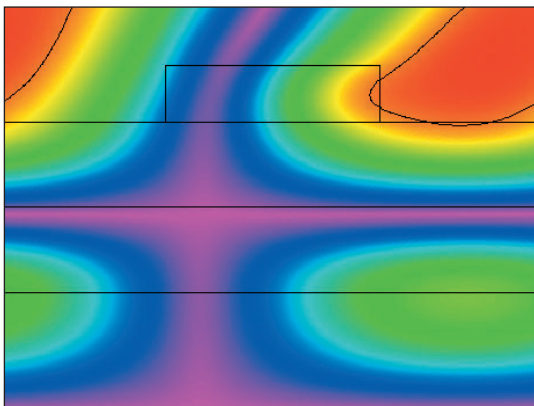
Advanced Metallic and Multilayer Dielectric Gratings

CUSTOM GRATING DESIGN AND FABRICATION

General Atomics has been developing advanced diffraction grating technology for government and commercial applications for many years. General Atomics has a highly experienced optics and laser technology staff with specialized diffractive optic design and fabrication capability.

Researchers use specialized rigorous coupled-wave theory diffraction codes to design high performance resonance domain diffraction gratings and advanced optics. General Atomics is constantly pursuing research into advanced diffractive optics and is available for the design and production of novel prototype gratings. Gratings can be fabricated on a wide range of substrate materials, including glass, silicon and metals.

General Atomics has developed two distinct product categories of laser gratings: Apex and Pinnacle



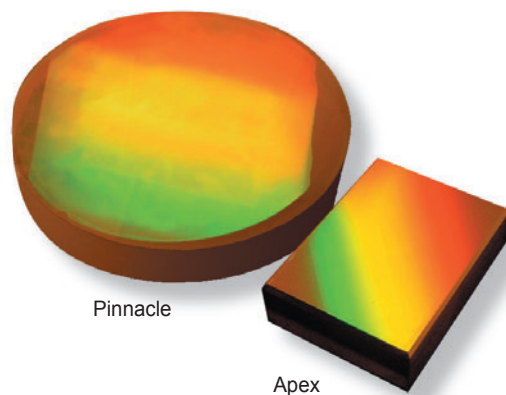
Gratings are modeled by calculating electric field distributions.

PINNACLE LASER GRATINGS

PINNACLE laser gratings are multilayer dielectric gratings. These gratings have structures produced entirely in dielectric layers and are designed to have the highest possible damage threshold and enhanced optical performance. Diffraction efficiency for the Pinnacle laser gratings can exceed 96%. Pinnacle laser gratings are also available in circular or rectangular sizes up to a maximum dimension of 220 mm with groove spacings of 1200–1800 lines/mm.

APEX LASER GRATINGS

APEX Laser gratings are high performance gold gratings available in circular or rectangular sizes up to a maximum dimension of 400 mm with groove spacings of 1200–1800 lines/mm. Depending on the application and size, the gratings are designed to have greater than 90% diffraction efficiency and a $\lambda/10$ optical wavefront.



GRATING CHOICE

Conventional Chirped Pulsed Amplification laser systems use metallic diffraction gratings in their compressors. The technology for fabricating these gratings is relatively mature, with ~90% efficiency being possible over wide chromatic and angular bandwidths. Multilayer Dielectric (MLD) gratings are a much newer technology. These gratings offer performance advantages over conventional metallic gratings in terms of maximum diffraction efficiency (although angular and chromatic bandwidth may not be as wide as the equivalent metallic grating) and damage threshold.

The main issue for metallic films is the low damage threshold compared to dielectric materials, which is more pronounced for the longer pulsed laser systems (5–10 ps compared to sub-ps). Higher damage threshold means smaller gratings and associated optics or higher energy (and power) in the system. MLD gratings can have significantly less absorption (near zero) than metallic gratings, which is an advantage for high average power laser systems.

HIGH AVERAGE POWER GRATINGS

High repetition rate short pulse laser systems can produce > 10 W average head load on the compressor gratings. For compact laser systems, conventional gold gratings are not able to handle this flux without severe distortions that destroy the grating's properties.

Multilayer dielectric gratings are able to handle high average power due to their low absorption; however they are not ideal for some short pulse applications due to their relatively narrow bandwidth performance.

General Atomics has developed a new line of gold diffraction gratings for high repetition rate laser systems that can withstand higher average power. The gratings are fabricated on highly conductive substrates that reduce the thermal distortion and allow the gratings to operate well above 10 W.

FACILITIES, EXPERIENCE AND INTELLECTUAL PROPERTY

General Atomics has established a leading diffractive optics research, design and production capability. The Diffractive Optics Laboratory is a 2,000 sq. ft. Class 5,000 cleanroom facility that contains a large size precision holographic lithographic system and custom coating, diagnostic and etching systems to fabricate and test advanced diffractive optics. Currently, the Diffractive Optics Group sells advanced gratings to various users in the high peak power short-pulse laser community, including major government and university laser facilities in the United States.

General Atomics holds significant intellectual property based around the design and fabrication of advanced gratings. General Atomics invented the use of hybrid diffraction gratings composed of dielectric grooves on the surface of a metallic base substrate, which would be directly applicable to Spectral Beam Combining systems. General Atomics also has multiple current patent applications in process concerning the fabrication and use of advanced gratings. It also has a license to use multilayer dielectric grating technology, which is held by the University of California and was invented by the Photonics Division Vice President.

For more information please visit
<http://www.galasers.com>
T: 858.457.8800
F: 858.457.8880
sales@galasers.com

General Atomics follows a policy of continuous product improvement. Specifications are subject to change without notice.