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Advantages of VPH Gratings

The term 'diffraction grating' often brings to mind a surface relief grating, with ruled lines and a delicate surface. A transmission grating, however, opens up many new options for the optical designer. In this tech note, we consider one special type: volume phase holographic (VPH) gratings. With superior optical performance and design flexibility in a robust package, VPH gratings are ideal for applications spanning 300 to 2500 nm and 150 to 5000 lines/mm, from laser pulse compression, spectroscopy, imaging, and optical coherence tomography to astronomy.

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Wasatch Photonics TECH NOTE

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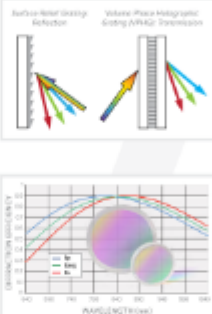
Volume phase holographic (VPH) gratings are made by holographically imaging a periodic structure of high and low index of refraction regions into dichromated gelatin sealed between two optical windows. The technique was originally commercially deployed by IBM in holographic barcode scanners, but has since been adapted for use in many optical instruments, as well as telecommunications.

The process can be used to manufacture very high quality diffraction gratings in volumes of 1 to 1000 pieces or more.

Every grating is an original, not replicated from another grating. With no 'original' grating to wear out or degrade, consistent performance can be achieved from one grating to the next – in volume, and indefinitely. The flexible nature of the manufacturing process also makes it possible to easily and cost effectively customize and optimize VPH gratings to each application by adjusting groove density, bandwidth, polarization sensitivity, and other parameters – in multiple iterations.

BEAUTIFUL EFFICIENCY CURVES

The transmissive, holographic nature of VPH gratings allows them to operate at high peak diffraction efficiencies, ranging from 90% for a 200-300 nm bandwidth (Wasatch Photonics' patented HD design) to 95% for a single wavelength optical laser pulse compression grating design. This is up to 40% greater than reflective surface relief gratings, which can also have very jagged, asymmetric efficiency profiles that weakly favor, with system response, a VPH grating's efficiency. In contrast, varies smoothly with wavelength, and can be resolved at the design stage for inclusion in system performance models, and manufactured dependably to the specifications of that design. The encapsulated nature of VPH gratings also allows the application of high-performance, antireflection (AR) coatings on the surfaces of the element. These coatings offer further optimization of performance, and can be customized as needed for CCMs.



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