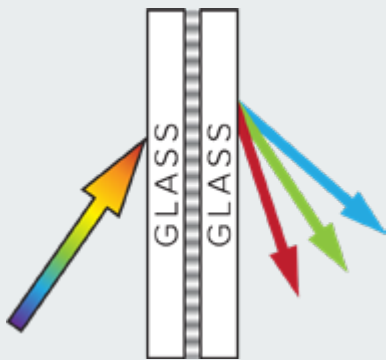


VPH Gratings  
Light is Precious

*Wasatch*) Photonics

# VPH Grating Technology

Volume Phase Holographic (VPH) transmission gratings were first developed at Bell Labs in 1968 as an alternative to ruled surface relief gratings. This unique form of diffraction grating surmounts many of the drawbacks of conventional reflection gratings, delivering significantly higher efficiency, greater dispersion, and better polarization characteristics in a robust package. The founders of Wasatch Photonics were some of the early innovators in this field, developing the foundation for the proprietary and patented design technologies we use to optimize each grating to its application, from stock gratings for R&D to custom gratings for our many OEMs. *VPH grating technology is at the heart of everything we do.*



## Volume Phase Holographic Gratings

VPH gratings are created by imaging a periodic structure of high and low index of refraction into dichromated gelatin hermetically sealed between two optical windows. This process allows us to generate very high quality diffraction gratings in volumes of 1 to 1000 pieces or more. It also allows us to quickly and cost-effectively optimize our gratings to each application by adjusting line density, bandwidth, polarization sensitivity, and other parameters – delivering that same performance consistently in volume. Our gratings have been designed into commercial OCT diagnostic systems, spectroscopic instruments, ultrafast laser amplifiers, and large format telescopes around the world.



## What are the Advantages?

VPH gratings offer higher peak diffraction efficiency and more smoothly varying spectral profiles than surface relief gratings. They also enable more compact, transmissive designs. Our expertise in broad bandwidth, low polarization dependence designs with minimal losses enables optical instrumentation with enhanced signal to noise, making our VPH gratings ideal for photon-precious applications. Encapsulating the grating structure between two AR coated surfaces ensures easy cleaning & handling, excellent wavefront characteristics, and long-term durability.



# Why Wasatch for Transmission Gratings

In the competitive world of optical components, what makes one company different than the rest? It's a combination of innovation, experience, and passion that adapts and grows as industry and technology change. Wasatch Photonics has been manufacturing volume phase gratings for research and OEMs for 20 years, and no one does it better.

Independently owned & innovation-minded, we have the freedom to pursue the projects with the potential to do the most good, and the passion and determination to see them through. We are constantly building toward the future, with expanded capacity, new talent, and better processes to sustain our momentum. And through it all, we are keeping our eye on what is important to you:

1

## Superior performance

We take the inherent efficiency of VPH gratings to new heights with our optimized designs, excellent spatial uniformity, low scatter, and ghost-free manufacturing processes. Each grating is validated by our metrology lab to guarantee superior performance.

2

## Innovation in design

We draw on multiple patented & proprietary design technologies to optimize our gratings to your needs. This is backed by decades of experience in collaborative development of optical systems. Each grating is an original, allowing you to quickly test out new designs.

3

## Rapid, knowledgeable support

We support all inquiries with application-specific expertise and high quality service. Our selection of online quick-order gratings speed R&D, while custom orders & OEMs benefit from direct access to our design and operations teams from concept to delivery.

4

## Reliability in volume

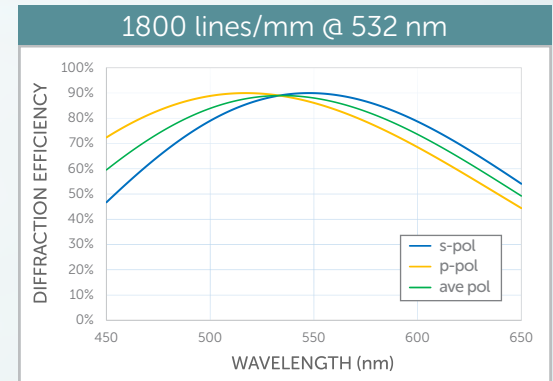
As the leading supplier of gratings for ophthalmic OCT diagnostic systems, we've demonstrated our ability to consistently supply robust, high-quality product in volumes of thousands per year. Many of our gratings have been in service for well over a decade!



# Designed to fit your unique optical needs

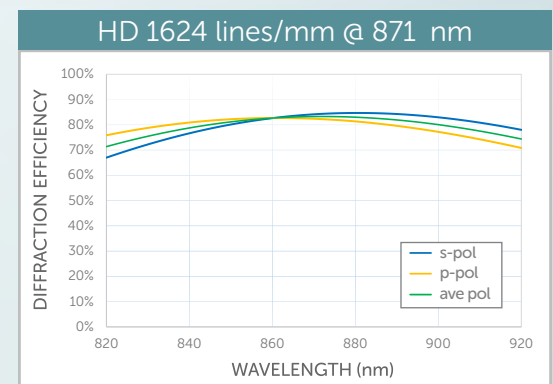
## CLASSIC GRATINGS

Our classic grating designs can be customized to serve a diverse range of applications while providing excellent 1<sup>st</sup> order diffraction efficiency and smoothly varying spectral profiles over broad bandwidths. This is possible due to our flexible design process, in which multiple parameters can be used to control center wavelength, bandwidth, dispersion, efficiency profile, polarization properties, and angle-tuning behavior. Our classic gratings can be angle-tuned to shift the wavelength of peak efficiency, making them well-suited for use in astronomical telescopes.



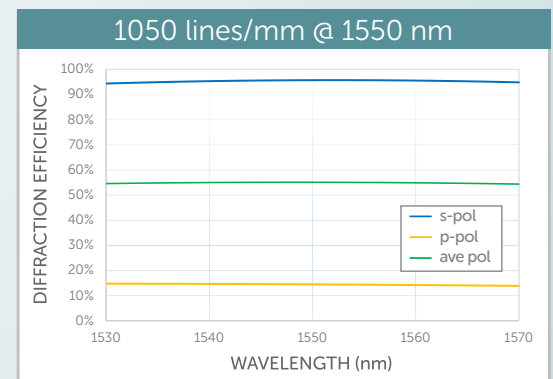
## APPLICATION-SPECIFIC

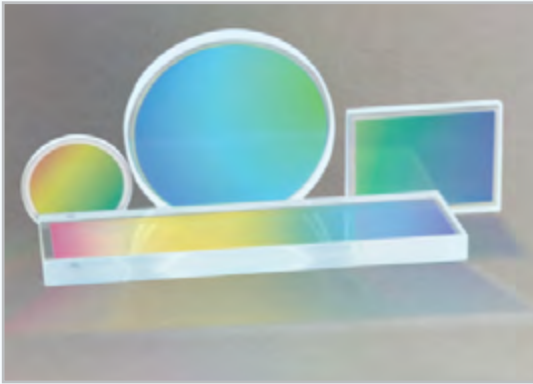
Spectroscopy and OCT require greater dispersion and minimal polarization sensitivity over broad bandwidths, a need we meet with our patented Dickson and HD grating designs. We developed the Dickson grating to provide extremely high efficiency for both s- and p-polarization, and have built on this expertise with our exclusive, patented HD grating design for even wider bandwidths. These technologies allow us to deliver remarkable s- and p-pol efficiency over 20-200 nm bandwidths for superior signal to noise, sensitivity, and speed in spectroscopy applications.



## POLARIZATION-ENHANCED

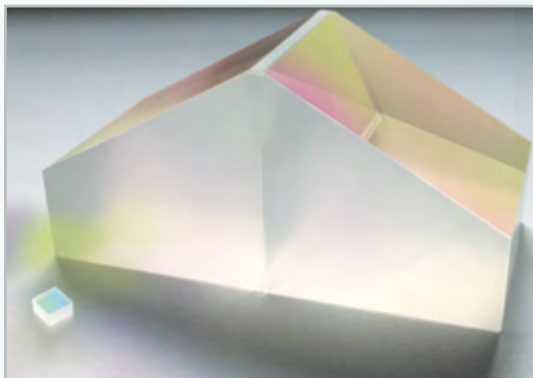
Laser applications such as pulse amplification, laser filtering, and fundamental optics benefit from the exceptionally high s-pol 1<sup>st</sup> order diffraction efficiency of our polarization-enhanced designs. These gratings can be manufactured in dimensions from 8 to 300 mm with low wavefront error for use in the dispersion and manipulation of laser light. Our polarization-enhanced designs offer high uniformity, low scatter, and excellent TWE for minimal beam distortion and loss when used for pulse stretching and compression in fs lasers, ps lasers, and OPAs.





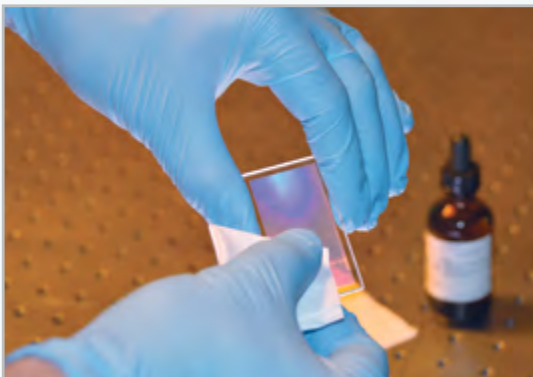
## WAVELENGTH & SIZE

The flexible nature of our design and manufacturing process allows us to quickly and easily create gratings for your specific application and needs. We work at UV, VIS, & NIR wavelengths spanning 300-2500 nm, with bandwidths of 20-800 nm and line frequencies of 150-5000 lines/mm. We fabricate on multiple glass types, in any size or shape that can be drilled or diced, from 8 mm to 30 cm. Order online from our selection of stock gratings for rapid delivery, or talk to us about designing a custom grating, grism, or unique optic for your next R&D project or product development.



## OEM & CUSTOM DESIGNS

We apply our deep understanding of optical design to support our R&D and OEM customers in creating smaller, more sensitive, cost-effective instruments for a broad range of applications. With 20 years of manufacturing experience and extensive in-house processing & metrology capabilities, we have the resources to provide you with high quality, premier performance gratings customized and AR-coated to your specific needs. We work closely with our OEMs from initial concept to product launch, supporting volumes of tens to thousands per year.



## ROBUST & HIGH QUALITY

Our manufacturing technique encapsulates the grating structure between two AR-coated surfaces for easy cleaning & handling. Hermetically sealed against the elements, VPH gratings have been used in the field, the clinic, and even in space. With >100,000 gratings deployed in the field since 2002, we have the track record to affirm our commitment to quality. Our ability to design, characterize, and deliver low-aberration gratings with guaranteed spectral efficiency allows you to create best-in-class optical systems that push the limits of technology.

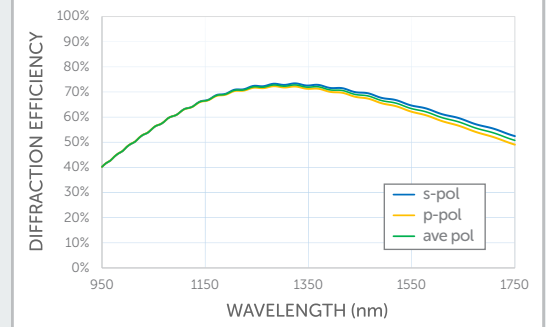
# Applications driven by performance

## SPECTROSCOPY

Raman, NIR, and fluorescence are all light-starved applications that demand optics with superior efficiency over broad bandwidth. Our gratings deliver, providing superior signal-to-noise for detection of small signals. VPH gratings enable transmissive spectrometer designs that are smaller in size, low aberration, and easy to align. Drawing on our multiple patented designs and experience in spectroscopy, we can balance bandwidth, polarization, and efficiency to optimize your design.



250 lines/mm @ 1250 nm

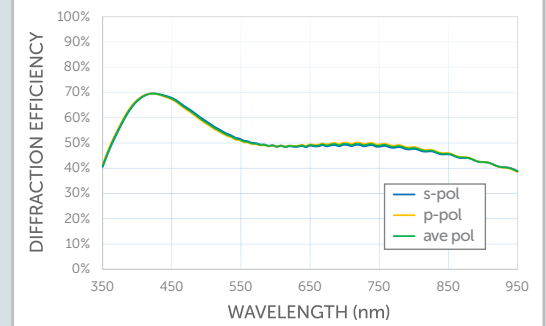


## SPECTRAL IMAGING

VPH gratings allow compact, straight-pass hyperspectral instrument designs, delivering exceptional 1<sup>st</sup> order diffraction efficiency for greater sensitivity and faster imaging rates. VPH gratings display near-zero ghosting & scatter to reduce stray light, with low wavefront error for clearer images. Our broadband designs are well-suited to applications in food quality and remote sensing in the visible and into the SWIR, while their robust packaging allows easy cleaning & handling in the plant and the field.



400 lines/mm @ 450 nm

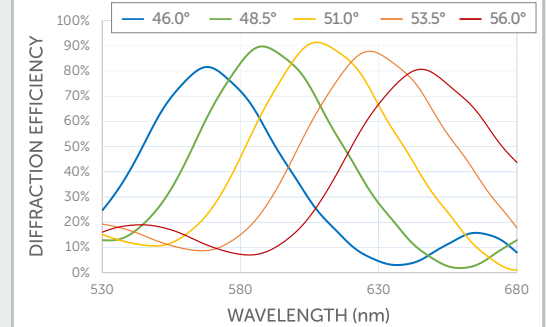


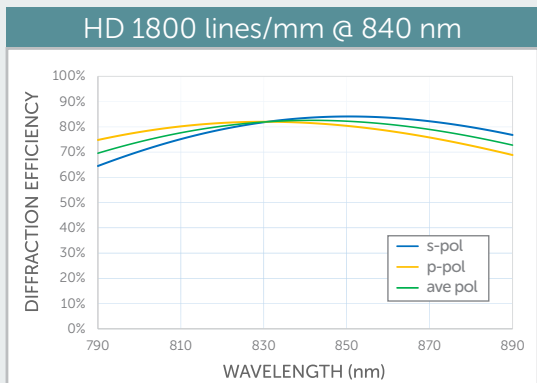
## ASTRONOMY

Our gratings are deployed in telescopes around the world, including LAMOST (China), MEGARA (Spain), & 4MOST (Chile). We collaborate with you from the earliest stages of your project to create high throughput medium- to large-format VPH gratings customized to your research needs. Our robust, high efficiency gratings provide the broadband performance and tunability you need for maximum flexibility, while our history and experience ensure a lifetime of insight into the beyond.



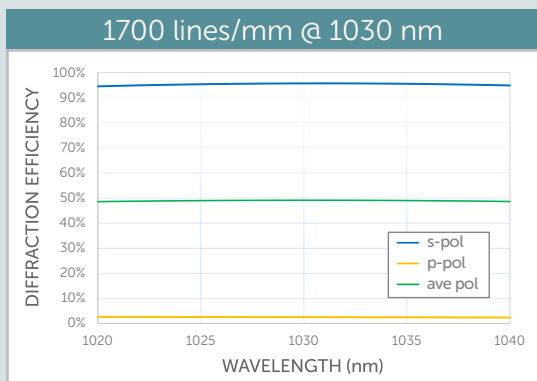
2550 lines/mm @ 600 nm





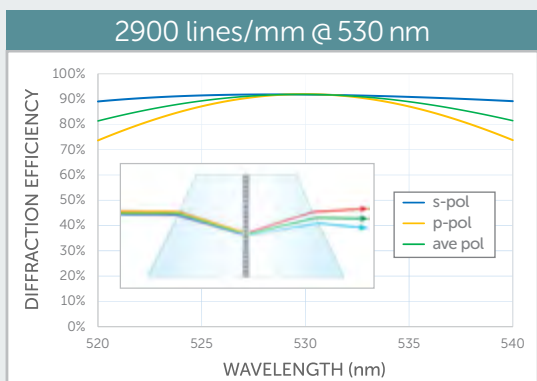
## OCT IMAGING

The clearest, deepest spectral domain optical coherence tomography (SD-OCT) images require high signal to noise over broad bandwidths. Our patented gratings for OCT lead the market, delivering superior 1<sup>st</sup> order diffraction efficiency and low scatter for all polarizations, even at the extremes of a 100-200 nm bandwidth range. This translates into less roll-off and faster scan rates for high-resolution imaging in ophthalmology, guided surgery, diagnostics, and nondestructive testing.



## PULSE COMPRESSION

Our polarization-enhanced VPH gratings are ideal for pulse stretching and compression in ultrafast laser systems. These ultraclear transmission gratings deliver excellent 1<sup>st</sup> order diffraction efficiency for s-polarized light at high dispersion, and over broad bandwidths. High spatial uniformity, near-zero scatter, and low TWE over the full clear aperture minimizes beam distortion and maximizes peak power. Transmission gratings also enable compact, folded designs.



## GRISMS & NOVEL OPTICS

The flexibility in our VPH grating manufacturing process allows the creation of unique optics beyond the typical diffraction grating. Grisms are one such example. This compound optical element combines a GRating and prISM to disperse light in a straight-pass configuration for imaging spectrographs and other compact optical designs. We can also manipulate the properties of VPH gratings to create variable attenuation polarizers and other custom holographic optics.





Where many see a world full of problems, we see undiscovered solutions. While the path there is rarely direct, a willing force will find its way. At Wasatch Photonics, our products provide the power behind your ideas to solve complex issues, understand the world around us, and unlock answers to the challenges we face as citizens of our world. Every idea is precious, every solution is unique, and by looking at things from a shared perspective, we can find our way there together.

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