



**Bayfol® HX120**

Solutions for optical filter applications  
with volume holographic optical elements  
(vHOE)



## Bayfol® HX120 – new light management flexibilities



Our mission to make the world a brighter place can also be taken literally! With our Bayfol® HX product range, we not only offer new designs and optical effects for your products. We also help enable light management flexibilities that seemed impossible in the past. For more, check out the Bayfol® HX flyer ([Link](#)).

Bayfol® HX120 is a light sensitive film that can be recorded with the appropriate laser light within the spectral range of 440 nm to 680nm and is optimized for the spectral range of 500 nm to 680 nm.



### Bayfol® HX120 in optical filter applications

With its unique properties to record volume holographic optical elements (vHOEs) as specific wavelength filters, Bayfol® HX120 is already used in optical filter applications such as metaAIR® by Metamaterial Inc. ("META™") ([www.meta-air.com](http://www.meta-air.com)).

metaAIR® by META™ is a triple-layer holographic optical filter that offers an excellent combination of laser glare protection and transparency that meets the high demands of aviation customers. Its performance was made possible by Bayfol® HX120. It has been available since 2019. metaAIR® is a product designed and engineered by META™ with vHOE recorded on the jointly developed Bayfol® HX120. It is now available for purchase through Satair (SATAIR A/S) ([www.satair.com](http://www.satair.com)).

To see how the glasses work visit [www.meta-air.com](http://www.meta-air.com)

Besides laser protection for pilots in the aerospace industry, other possible application areas for Bayfol® HX120 include:

- Laser protection in the medical industry or in national security
- Sensor protection in the transportation industry
- Fluorescence spectroscopy in biomedical instruments

Such optical filters based on vHOE recorded on Bayfol® HX120 offer a more sustainable solution compared to traditional optical coatings made with rare earth metal (vapor deposition), saving an estimated 6 orders of magnitude of energy per m<sup>2</sup> produced.



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## Metamaterial Inc. are the go-to partner

Thanks to experience in handling Bayfol® HX120, META™ is an excellent go-to-partner for such optical filter applications.

META™ designs and manufactures advanced functional materials. These are complex, structured materials that perform special functions, utilizing light and other forms of energy in new and often surprising ways. META™ engineers products at microscopic levels, creating novel functional materials and metamaterials with new properties and capabilities that go beyond those found in natural materials.

One of the technologies which the company specializes in is direct-write (masterless) holography. This enables design and fabrication of holograms as specialty optical elements that

can not only replace traditional lenses and mirrors but can provide optical functions that are very difficult to achieve with conventional optics.

META™'s holographic capabilities include holographic optical elements, light steering diffusers and notch filters (optical filters).



## Optical filters capabilities

META™'s holographic optical elements have the following characteristics:

- Extremely large area
- Flexible, stackable
- Spectrally selective filters with high optical blocking strength and angle control

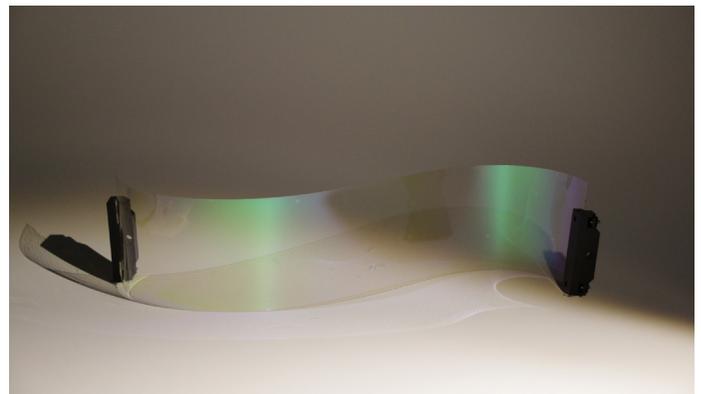


Image: Large form factor, high efficiency grating (99.999 % at 532nm), recorded with META™'s proprietary direct-write process on Bayfol® HX120.

Uniform conformal notch filters	Uniform slant notch filters	Spatially varying filters and gratings
<ul style="list-style-type: none"> <li>• Blocking notch wavelengths from 425nm – 650nm</li> <li>• Sizes up to 800 mm × 600 mm</li> <li>• Controlled filtering angle 0° – 90°</li> <li>• Can be applied as a multilayer stack</li> <li>• High luminous transmission (VLT&gt;60 % per layer), low haze (&lt;2 %)</li> <li>• Blocking strength up to OD6</li> </ul>	<ul style="list-style-type: none"> <li>• Arbitrary filtering slant angle (0° – 90°)</li> <li>• Angular bandwidths up to 30°</li> <li>• Sizes up to 300 mm × 300 mm</li> </ul>	<ul style="list-style-type: none"> <li>• Filters with blocking characteristics that can be controlled across the film</li> <li>• Arbitrary filtering wavelength and angle</li> <li>• Sizes up to 400 mm × 400 mm</li> </ul>

Find out more: [www.metamaterial.com](http://www.metamaterial.com)

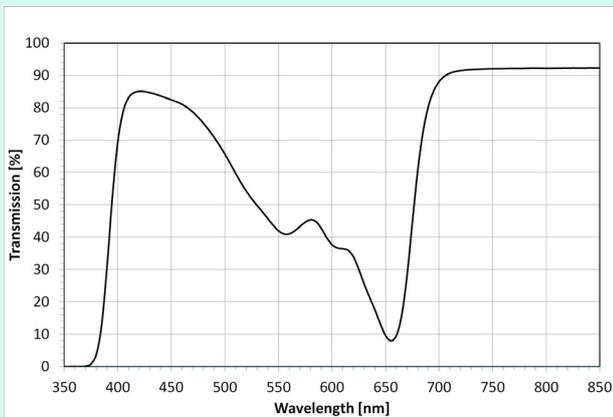
## Bayfol® HX120 – Technical details

Bayfol® HX120 consists of a three layer stack, the substrate, the light-sensitive photopolymer and a protective cover film.

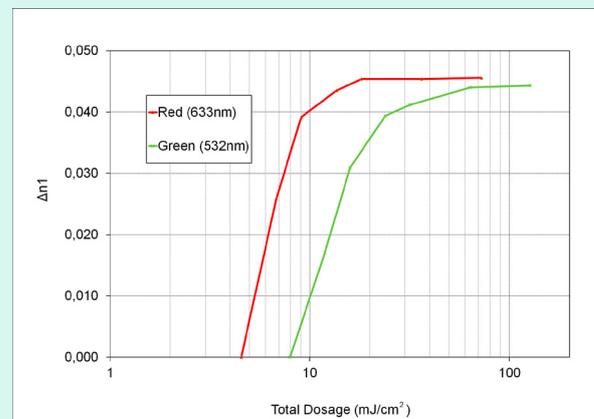
A triacetate (TAC) substrate with UV absorber and a polyethylene terephthalate (PET) protective cover film are used. See below extract from the product data sheet ([Link](#)).

General properties			
Property	Value	Unit of measurement	Method
Typical substrate thickness	60	microns	acc. to ISO 4593, 23°C
Typical photopolymer thickness	30	microns	IR Interferometer
Typical cover layer thickness	50	microns	acc. to ISO 4593, 23°C
Optical properties			
Property	Value	Unit of measurement	Method
Transmittance (Unrecorded film, w/o cover foil)	See Annex graph 1, for details of the transmittance spectrum	%	ASTM E 01348
Maximum refractive index modulation $\Delta n_1$ per recording wavelength $\lambda$			acc. to ISO 17901-2
$\lambda = 633 \text{ nm}$	> 0.04		
$\lambda = 532 \text{ nm}$	> 0.04		
Typical recording dosage needed to achieve above $\Delta n_1$ values	See Annex graph 2, for details of the recording dosage	mJ/cm <sup>2</sup>	

Graph 1: Direct Transmission Spectrum



Graph 2: Dosage curves  
(Reflection Holograms in 2-Beam Geometry)



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