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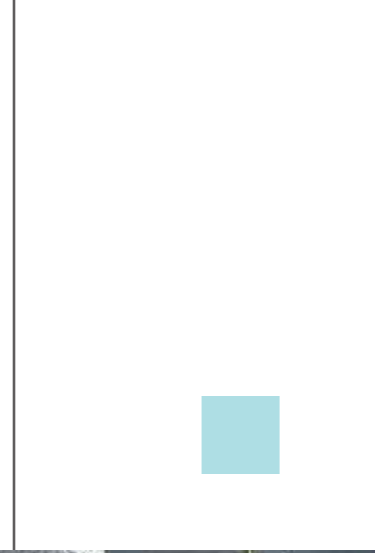
E-mail:info@hb-optical.com

www.hb-optical.com



HB - OPTICAL
Precision Optical Filters & Reflectors





HB Optical specializes in the design and manufacture of precision optical filters and coatings. We employ scientists and technicians whose combined expertise covers the spectrum from UV-Visible to IR.

HB Optical has more than 60 years of experience in manufacturing high quality interference bandpass filters and focusing UV cold reflectors for industrial and scientific applications, including biomedical and life science instrumentations, fluorescence studies, machine vision, analytical chemistry instruments and many others.

We manufacture a broad array of standard and custom components, including narrowband filters, wideband filters, dichroic filters, beamsplitters, hot mirrors, cold mirrors, longpass filters, shortpass filters, variable neutral density filters, UV cold reflectors. These components meet or exceed industry-established specifications.

With our numerous vacuum coating facilities, we have the capability for coating a full range of dielectric, metal, and insulation materials. State-of-the-art facilities for all types of thin-film vacuum deposition, and computer-aided design optimization allow maximum flexibility while ensuring the highest quality. We achieve the plasma reaction magnetron sputtering (PARMS), physical vapor deposition (PVD) with or without ion-assisted deposition (IAD) of refractory oxides, as well as thermal evaporation of metal salts and metal alloys. All of our coating systems have been designed to enhance our proprietary coating processes.

Optical characterization, spectral and photometric performance data are provided as required. For maximum precision and reliability, we import a variety of spectrophotometers that generate accurate spectral measurement data in the UV, VIs and NIR regions. Our latest spectrophotometers are Cary 7000, Cary 6000i and Varian-Cary300 etc. We are capable of a complete range of spectrophotometer measurements. We offer traceable transmission, reflectivity, and optical density measurements (reliable to OD8) in the UV to near IR spectral region.

Every standard and custom component is thoroughly inspected and tested by quality control inspectors during fabrication and prior to shipment. HB Optical has implemented and maintained a quality management system which fulfils the requirements of the standards ISO 9001:2015 for the scope design and manufacture of optical filters and reflectors.



National & Industry Standards

GB/T 26328-2010	Interference filter for biochemical analysis instrument
GB/T 26331-2010	Test method for environmental adaptability of optical film components
GB/T 26332.1-2018	Optics and optical instruments Optical film Part 1: Definition
GB/T 26332.2-2015	Optics and Photonics Optical Film Part 2: Optical Properties
GB/T 26332.3-2015	Optics and Photonics Optical Thin Film Part 3: Environmental Adaptability
GB/T 26332.4-2015	Optics and Photonics Optical Coatings Part 4: Specific test methods
GB/T 26332.5-2015	Optics and Photonics Optical Coatings Part 5: Minimum requirements for antireflecting coatings
GB/T 26332.6-2015	Optics and Photonics Optical Coatings Part 6: Minimum requirements for reflecting coatings
GB/T 26332.7-2015	Optics and Photonics Optical Coatings Part 7: Minimum requirements for neutral beam splitter coatings
JB/T 11532-2013	Linear variable neutral density filter
JB/T 12112-2015	Reflectors for digital cinema projectors technical specification
JB/T 13358-2018	Optical interference band pass filters
JB/T 13360-2018	Interference filters used in fluorescence detection analysis
JB/T 13361-2018	Optical filters for UV, visible and near-infrared spectral ranges

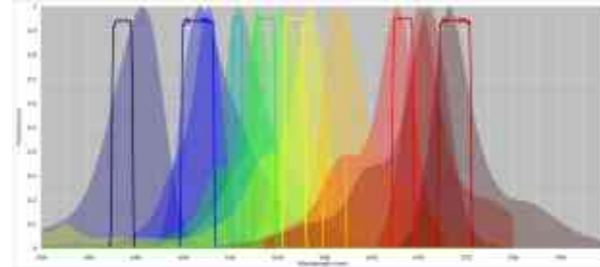
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Fluorescence PCR Filters

HB Optical uses the plasma reaction magnetron sputtering (PARMS) process to manufacture fluorescence PCR filters. The optical filters have high transmittance, deep blocking, and sharp edge.

The filter's spectrum design is optimized to minimize crosstalk in Q-PCR and D-PCR.

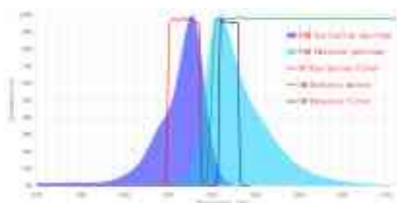


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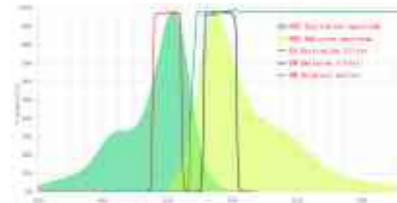
Central Wavelength	400nm to 850nm
Full Width at Half Maximum	10nm to 50nm
Peak Transmittance	Tpk ≥ 90% (Typically ≥ 95%)
Blocking	300-1200nm, OD ≥ 6 (or T ≤ 0.0001%)
Product Size	Φ25mm, Φ20mm, Φ12mm, or other customer size

Typical PCR Filter Sets

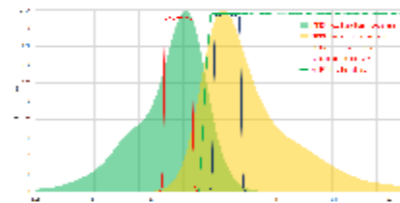
Fluorescent dyes Typical PCR filter set
FAM EX470/30
SYBR Green EM525/20
Eva Green DM490



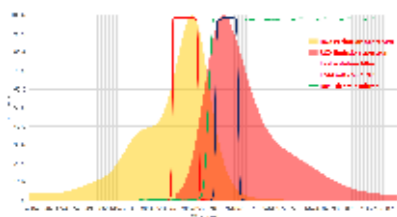
Fluorescent dyes Typical PCR filter set
HEX EX520/20
VIC EM565/20
JOE DM540



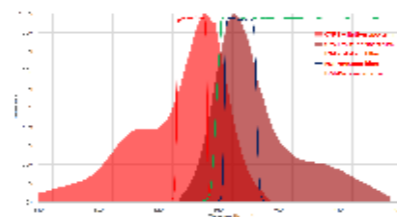
Fluorescent dyes Typical PCR filter set
Cy3 EX545/20
TAMRA EM585/20
Atto 550 DM560



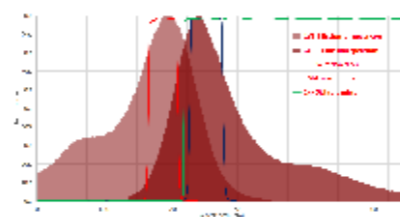
Fluorescent dyes Typical PCR filter set
ROX EX570/20
Texas Red EM610/20
DM590



Fluorescent dyes Typical PCR filter set
Cy5 EX630/20
Quasar 670 EM665/20
DM645



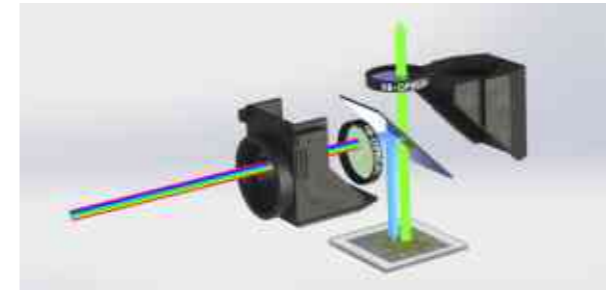
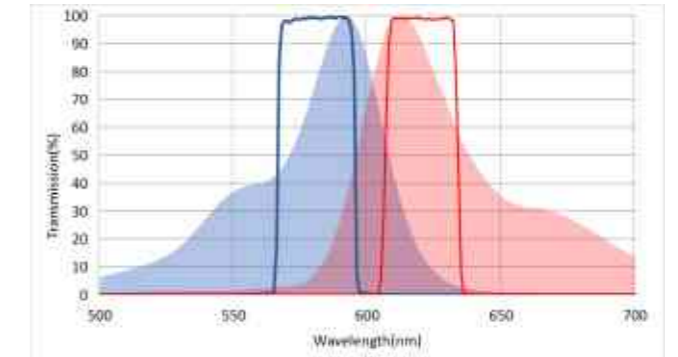
Fluorescent dyes Typical PCR filter set
CY5.5 EX655/20
Quasar 705 EM715/20
DM685



Fluorescence Microscope Filters

HB Optical uses the plasma reactive magnetron sputtering (PARMS) process to manufacture optical filters for fluorescence microscopes. The optical filters have high transmittance, deep blocking, and sharp edge.

It is capable of adapting to the application requirements of various typical fluorescent groups and generating high-quality fluorescent images with high brightness, contrast, clarity.



Specifications:

- CWL: 350-850nm optional
- FWHM: 10-100nm optional
- Blocking: >OD6@300-1100nm
- Size: D25mm, D20mm or other customer size

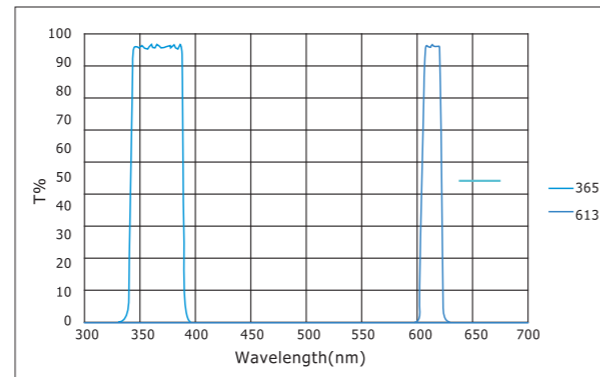
Product Specifications:

Filter Set	Excitation Filter	Emission Filter	Dichroic Mirror
AF01	EX365/50	EM450/65	DRLP400(DM402)
AF02	EX475/40	EM535/45	DRLP505(DM502)
AF03	EX560/55	EM645/75	DRLP595(DM597)
AF04	EX500/25	EM545/35	DRLP525(DM519)
AF05	EX525/45	EM595/60	DRLP560(DM562)
AF06	EX440/21	EM480/30	DRLP455(DM459)
AF07	EX607/75	EM695/55	DRLP650(DM652)
	EX560/40	EM635/60	DM592
	EX480/30	EM535/40	DM505
	EX375/28	EM460/50	DM412
	EX546/22	EM590/33	DM565
	EX435/20	EM480/30	DM455

Time-resolved Fluorescence Filters

HB Optical manufactures typical optical filter set 365nm and 613nm for time-resolved fluorescence instrument. These optical filters effectively increase the energy of

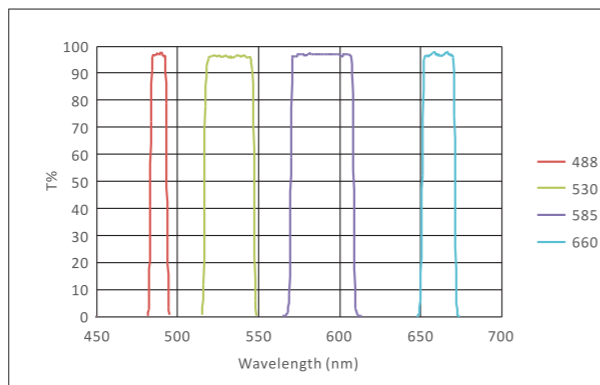
excitation and emission light, eliminate background fluorescence, and improve sensitivity and accuracy for the instrument.



Flow Cytometry Filters

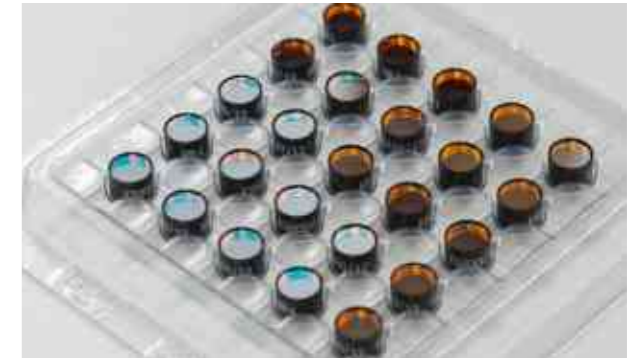
Based on plasma reactive magnetron sputtering coating technology, HB Optical developed special filter groups for flow cytometers, such as laser line narrow-band filter, dichroic mirror, fluorescence excitation filter, and reflector, which have high transmittance, deep blocking, high

reflectivity, and high surface accuracy. The filters effectively remove stray light from light sources, reduce spontaneous fluorescence interference, and improve signal-to-noise ratio.



Point of Care Testing (POCT) Filters

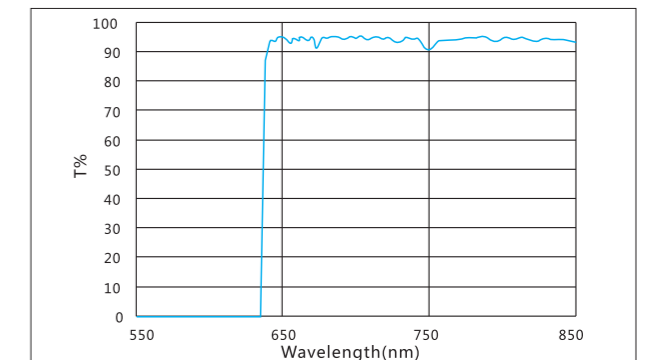
HB Optical has designed and developed filters for various POCT equipments. The optical filters are suitable for optical detection methods including absorption photometry, fluorescence spectrometry, chemiluminescence, Raman scattering, absorption photometry, etc.



Raman Detection Filters

Typical Raman detection filters in HB Optical include Laser line bandpass filters, long pass & short pass filters with steep cut-on & cut-off, and notch filters. Cut-off steepness (wavelength interval from 50%

transmission position to OD6 blocking position) is an important index for evaluating Raman filter performance. HB Optical could provide Raman filters with a cut-off steepness of up to 1%.



Product Application:
it can be used for qualitative and quantitative analysis in the fields of chemistry, polymer, pharmacy, semiconductor, gemology and medical treatment.

- ⊗ Substance identification
- ⊗ Crystallinity analysis
- ⊗ Stress distribution
- ⊗ Structure identification
- ⊗ Concentration distribution

- Product Type:**
- ⊗ Laser line narrow-band filter
 - ⊗ Steep cut-off long pass/short pass filter
 - ⊗ Notch filter

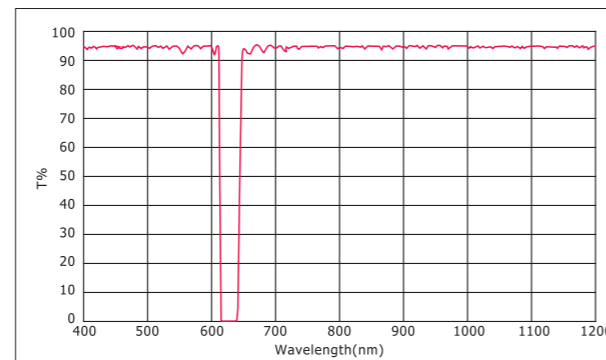
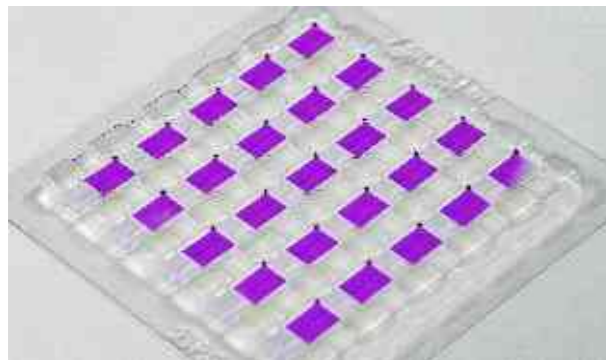
Notch Filters



HB Optical provides notch filter with good optical characteristics as well as excellent environmental adaptability.

Typical Application:

- Fluorescence endoscope
- Raman detection
- Laser system



Technical Parameters

Optional Band	300nm~1200nm
Notch Bandwidth	20nm~100nm
Passband Transmittance	≥90%
Blocking	OD4~OD6
Outside Diameter	Φ12/Φ25/Φ25.4/customization
Thickness	3.5mm/6mm/customized
Environmental Suitability	Conform to MIL-STD-810G, ISO 9211-3, GB/T 26331, GB/T 26332 etc.

Multi Bandpass Filters

HB Optical developed Multi bandpass filter (also known as multi-wavelength and multi-color). This type of optical filter is high-performance optical thin film filter with multiple transmission passbands integrated on a single filter.

There are matched multi band excitation filter, emission filter and dichroic mirror. All these multi band filters perform high transmission, sharp edge and deep blocking.

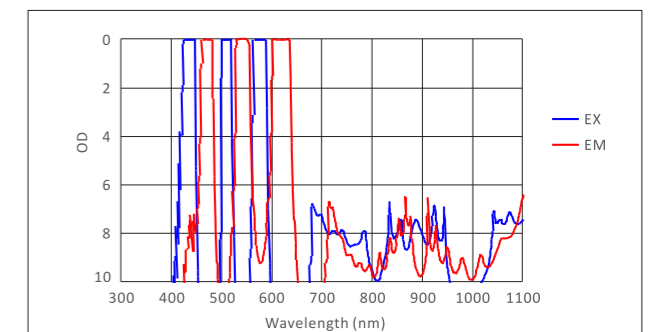
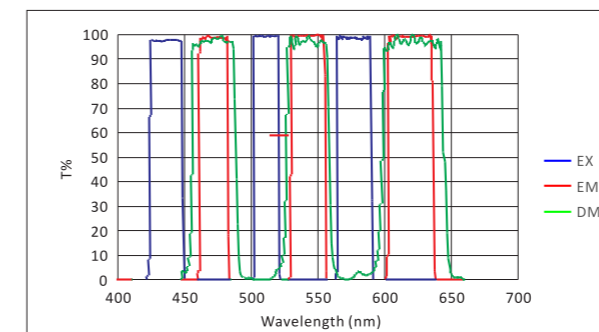


Product Type:

- Dual-band filter sets
- Triple-band filter sets
- Quad-band filtersets

Application:

- Fluorescence Microscope
- Multicolor PCR System
- Multicolor FISH



Biomedical Filters

Biomedical filters are specially designed for biomedical instrumentation, including chemistry analyzers and microplate readers. These bandpass filters include standard or custom matched filters. Biomedical filters are key components in biochemistry analyzers and microplate readers. After six generation upgrades, biomedical filters in

HB Optical have unique characteristics of ultra-high signal-to-noise ratio, deep blocking and rectangle passband.

HB Optical developed 3 series, 80 wavelengths at range 340nm to 950nm and more than 200 models with size dia.10mm to dia.25mm or rectangle shape.



Technical Parameters

CWL Range	340nm-950nm
CWL Accuracy	±2nm
FWHM	8nm,10nm
FWHM Accuracy	±2nm
Blocking	≥OD6@200nm-1200nm
Diameter	10mm, 12mm, 12.7mm, 15mm or customer size
Thickness	6mm, 8mm or customer size
Surface Quality	80/50
Applicable Temperature Range	-50°C to 80°C

Product Specifications:

Model	CWL(nm)	FWHM (nm)	TPK (%)
BFS-HB-340	340	10	≥40%
BFS-HB-405	405	8	≥35%
BFS-HB-450	450	8	≥45%
BFS-HB-492	492	8	≥45%
BFS-HB-505	505	8	≥45%
BFS-HB-510	510	8	≥45%
BFS-HB-546	546	8	≥45%
BFS-HB-578	578	8	≥45%
BFS-HB-600	600	8	≥45%
BFS-HB-630	630	8	≥45%
BFS-HB-670	670	8	≥45%

UV-VIS-IR Narrow Band Interference Filter sets

HB Optical produces a high-performance narrowband and wideband bandpass filter with spectrum range from 200 nm to 15μm. The filter film is high-density hard film, which ensures a long service life, and the product is manufactured using ion beam assisted deposition (IAD) and plasma assisted deposition (PIAD).

The filters we provide have an extremely deep blocking, which can significantly improve the system's signal-to-noise ratio. Spectrum analysis, wavelength selection, laser communication, laser measurement and other fields make extensive use of products.

Technical Parameters:

CWL Accuracy	±20% of half bandwidth
FWHM Accuracy	±20% of half bandwidth
Blocking	< 0.01%
Diameter	12mm, 12.7mm, 15mm, 25mm, 25.4mm etc.
Clear Aperture	8.0mm, 8.0mm, 10.5mm, 20.5mm, 20.5mm etc.
Thickness	6mm, 8mm or customer required
Applicable Temperature Range	-50°C to +80°C

UV Bandpass Filters

Product Specifications:

Model	CWL(nm)	FWHM (nm)	TPK(%)
HB-BP214	214	12	10
HB-BP228	228	12	10
HB-BP254	253.7	12	20
HB-BP280	280	12	20
HB-BP289	289.4	12	12
HB-BP297	296.8	12	12
HB-BP307	307	12	15
HB-BP312	312.6	12	15
HB-BP337	337.1	11	35
HB-BP340	340	11	40
HB-BP352	352	12	35
HB-BP365	365	12	35
HB-BP380	380	12	35

Visible Bandpass Filters

Products Specifications:

Model	CWL(nm)	FWHM (nm)	TPK(%)
HB-BP404	404.7	10	35
HB-BP415	415	10	40
HB-BP435	435.8	10	35
HB-BP441	441.6	10	50
HB-BP488	488	10	50
HB-BP505	505	10	50
HB-BP508	508.5	10	50
HB-BP510	510	10	50
HB-BP514	514.5	10	50
HB-BP532	532	10	50
HB-BP535	535	10	50
HB-BP540	540	10	50
HB-BP546	546.1	10	50
HB-BP550	550	10	50
HB-BP570	570	10	50
HB-BP577	577	10	50
HB-BP578	578	10	50
HB-BP590	590	10	50
HB-BP600	600	10	50
HB-BP620	620	10	50
HB-BP630	630	10	50
HB-BP633	632.8	11	50
HB-BP636	636.2	11	50
HB-BPB47	647.1	11	50
HB-BP650	650	11	50
HB-BP656	656.3	11	50
HB-BP670	670	11	50
HB-BP690	690	11	50
HB-BP694	694.3	11	50

Infrared Bandpass Filters

Products Specifications:

Model	CWL(nm)	FWHM (nm)	TPK(%)
HB-BP706	706.5	11	80
HB-BP730	730	11	80
HB-BP766	766.5	11	80
HB-BP794	794.7	11	80
HB-BP780	780	11	80
HB-BP830	830	12	80
HB-BP850	850	12	80
HB-BP880	880	12	80
HB-BP905	905	12	80
HB-BP1064	1064	10	80
HB-BP1152	1152	11	80
HB-BP1310	1310	12	80
HB-BP1532	1532	10	80
HB-BP1600	1600	15,45	80
HB-BP1650	1650	45	80
HB-BP1700	1700	15,45	80
HB-BP1780	1780	48	80
HB-BP1810	1810	35,50	80
HB-BP1900	1900	53	80
HB-BP2000	2000	20,55	80
HB-BP2100	2100	60	80
HB-BP2200	2200	61	80
HB-BP2250	2250	62	80
HB-BP2300	2300	63	80
HB-BP2350	2350	64	80
HB-BP2400	2400	65	80
HB-BP2450	2450	65	80
HB-BP2500	2500	66	80
HB-BP3740	3740	120	80
HB-BP3900	3900	120	80
HB-BP4265	4265	120	80

High-performance narrow-band and wide-band infrared bandpass filters produced by HB-optical, with optical spectrum coverage range of 700nm~4300nm. Filters are

widely used in moisture separation, analysis, infrared measurement, gas detection and other fields.

Circular Variable Neutral Density Filters

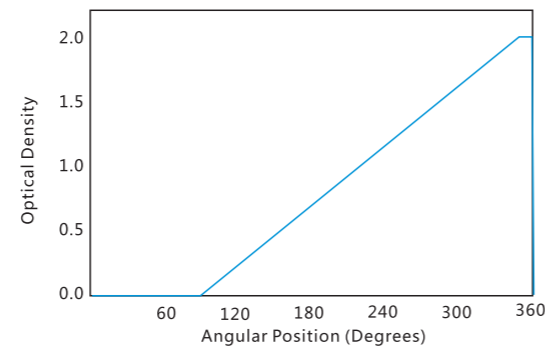
Circular ND filters provide continuously variable, linear attenuation of light by rotating the filter about its center. Transmitted intensity varies as a function of the optical density range.

The filter can be used for white light as well as for lasers. A large finite aperture can be attenuated by counter rotating two filters in series. Sizes are available from 25 mm to over 100 mm in diameter. The useable wavelength range is from 250nm to 2500nm.



Technical Parameters:

SubstrateMaterial	BK7/K9, Quartz
OutsideDiameter	Φ25-Φ200mm
InnerDiameter	7.5mm、8.0mm、8.3mm、25.4mm
Parallelism	3'
Standard Linearity	±5% oftheend-pointoptical density
OpticalDensity Deviation	±5% oftheend-pointoptical density
Coating Area	0°-270°、0°-300°、0°-310°
Wavelength Rang	380-2000nm(BK7/K9) 250-2500nm(Quartz)



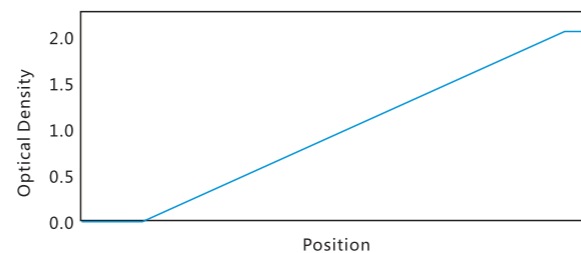
Linear Variable Neutral Density Filters

Designed to be spectrally flat from 400 to 700nm, they provide excellent attenuation for spectrometers and other optical instruments.



Technical Parameters:

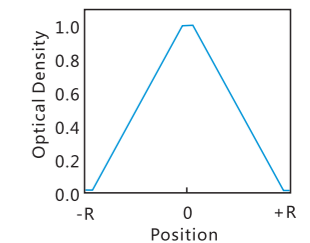
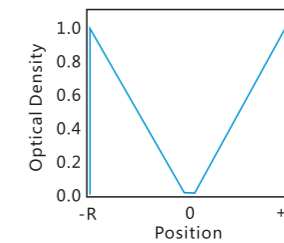
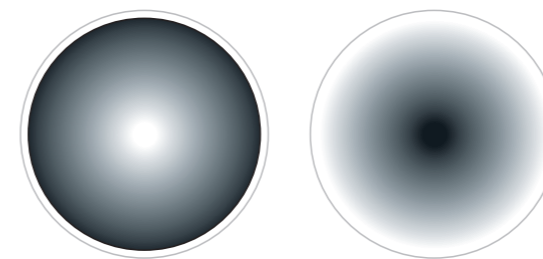
Substrate Material	Bk7/k9, Quartz
Parallelism	3'
Standard Linearity	±5% of the end-point optical density
Optical Density Deviation	±5% of the end-point optical density
Wavelength Rang	380-2000nm(bk7) 250-2500nm (Quartz)



Radial Variable Neutral Density Filters

Radial variable neutral density filter can attenuate light according to Gaussian function. The filter can be used for white light as well as for lasers.

The substrate, size, density and wavelength are available on customer requirements.



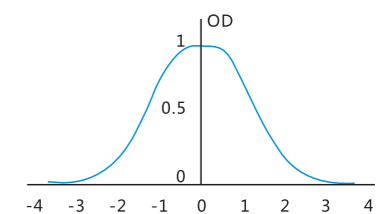
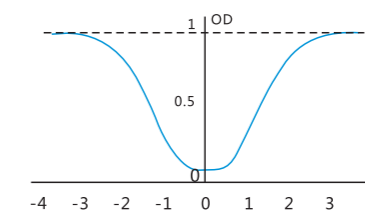
Technical Parameters:

Substrate Material	Bk7/k9, Quartz
Parallelism	3'
Optical Density Deviation	±5%
Wavelength Range	380-2000nm(bk7) 250-2500nm (Quartz)

Products Pecifications:

Model	Substrate Material	Diameter	Optical Density
SBDF10-B25	BK7/K9	Φ25	OD1
SBDF20-B25	BK7/K9	Φ25	OD2
SBDF30-B25	BK7/K9	Φ25	OD3
SBDF10-B50	BK7/K9	Φ50	OD1
SBDF20-B50	BK7/K9	Φ50	OD2
SBDF30-B50	BK7/K9	Φ50	OD3

Bidirectional Variable Neutral Density Filters



Circular Stepped Neutral Density Filters

The circular stepped density filters can attenuate light in discrete steps around the filter. The filter can be used for white light as well as for lasers. Sizes are available from 25mm to 150mm in diameter.

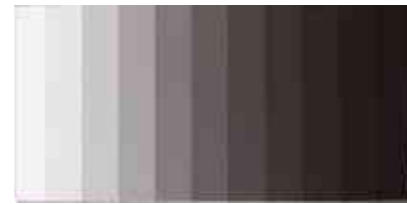


Product Specifications:

Model	Substrate Material	Diameter	Optical Density Series
CSND-B60CD	BK7/K9	Φ60×Φ8.3	D series
CSND-B60CE	BK7/K9	Φ60×Φ8.3	E series
CSND-B60CF	BK7/K9	Φ60×Φ8.3	F series

Linear Stepped Neutral Density Filters

The linear stepped density filter can attenuate light in discrete steps. The filter can be used for white light as well as for lasers.

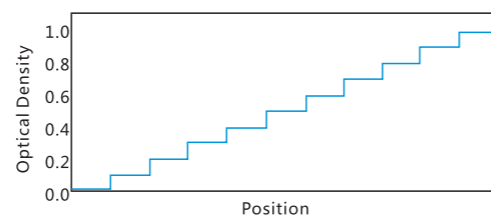


Products Pecifications:

Model	Substrate Material	Diameter	Optical Density Series
LSND-B50D	BK7/K9	50.8×25.4	D series
LSND-B50E	BK7/K9	50.8×25.4	E series
LSND-B50F	BK7/K9	50.8×25.4	F series

Technical Parameters:

Substrate Material	Bk7/k9, Quartz
Parallelism	3'
Optical Density Deviation	±5%
Wavelength Range	380-2000nm(BK7) 250-2500nm(Quartz)



Typical Stepdensitys

A	0.04	0.1	0.2	0.3	0.4	0.5					
B	0.04	0.2	0.4	0.6	0.8	1.0					
C	0.04	0.4	0.8	1.2	1.6	2.0					
D	0.04	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
E	0.04	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
F	0.04	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0

Machine Vision Filters and 3D Sensing Filters

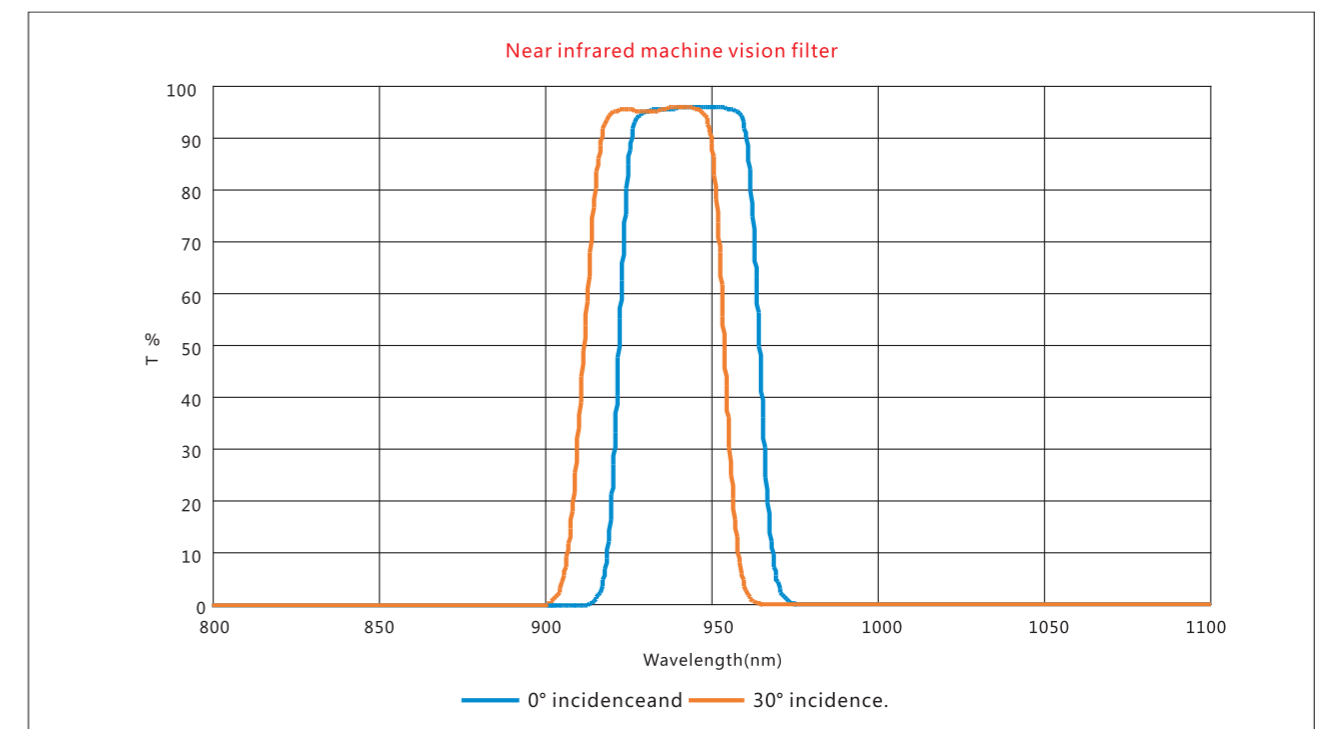
Machine vision filters are widely used in machine vision systems to extract characteristic spectra and eliminate stray light interference.

3D sensing filter is a kind of special near-infrared band-pass filter which is optimized to solve the problem that the field of view (FOV) of the lens is too large. It is mainly used in 3D cameras and lidar systems, and is one of the core devices of 3D cameras and lidar. This type of filter is placed

between the camera's lens and the near-infrared image sensor, allowing near-infrared light to pass through while filtering out ambient light. Its most distinguishing feature is that, even at large angles of incidence ($\pm 30^\circ$), the wavelength blue shift can be controlled within a reasonable range (the central wavelength shift is less than 12nm), while maintaining excellent optical performance.

Application:

- Face recognition
- Gesture recognition
- Car-assisted driving
- LIDAR



UV Optical Filters and Reflectors for IC Equipment

HB Optical manufactures various high-power aspheric deep ellipsoid mirrors, 45° plane cold mirrors, dielectric film mirrors, aluminum enhanced mirrors, 365nm band-pass filters, optical alignment mirrors, special-shaped mirrors, and so on are examples. The wavelength range is 200 to 400nm. In the HB-ultraviolet optical reflector and filter, which has stable performance in high temperature field environments, quartz glass or metal substrate is used.

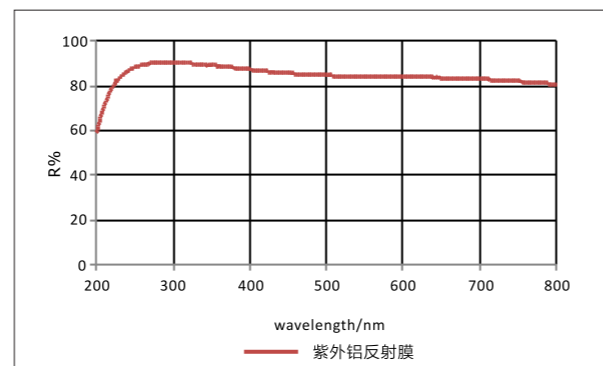
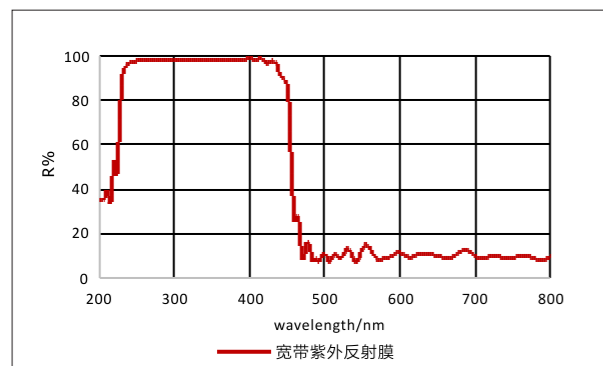
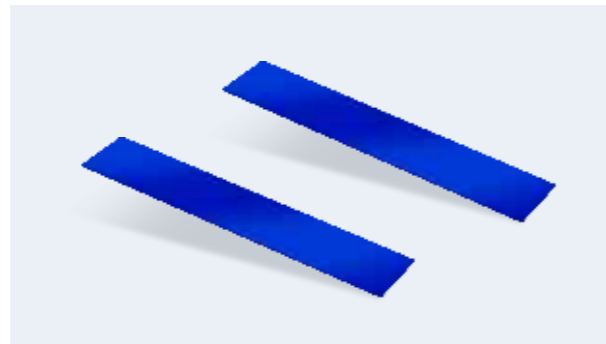
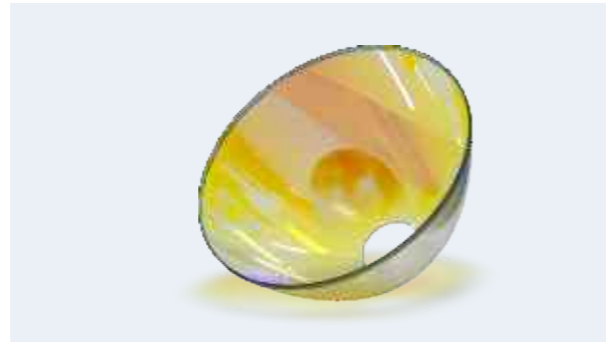
The spectral performance design optimizes the film thickness distribution based on incident light angle change and employs the best design to ensure optical performance at large angles of incidence. Other applications for similar products include FPD LCD panel exposure, PCB circuit board exposure, high-power optical fiber coating curing, UV ink curing, ultraviolet sterilization, and so on.

Product Type:

- Ellipsoidal Reflector
- Metal Substrate Reflector
- Narrowband Filter
- Ultraviolet heat insulation filter
- Plane cold mirror

Application:

- UV cure
- Spectral analysis instrument
- Ultraviolet sterilization



Reflectors and Filters for Sunlight Simulation and Illumination

Different reflectors and filters are selected for sunlight simulation equipment based on the light source and lighting scene requirements, such as ellipsoidal reflectors, parabolic reflectors, plane reflectors, AM1.5 filters, daylight filters, window glass, ultraviolet daylight filters 290nm, 275nm, and 250nm, among others. Light can be improved by using an ellipsoidal reflector or a plane reflector. Source utilization ratio and reducing optical path length; Source utilization ratio and reducing optical path length; A

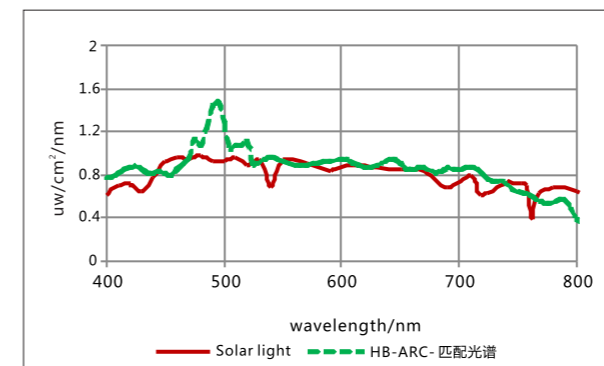
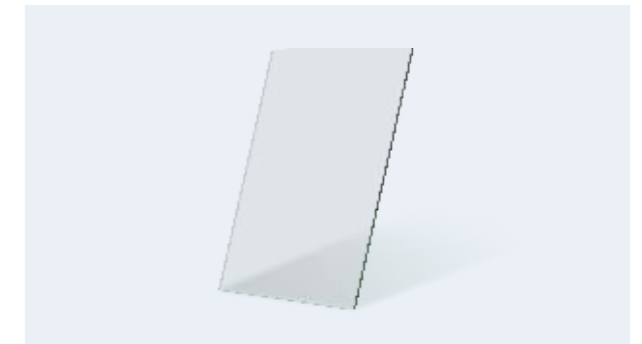
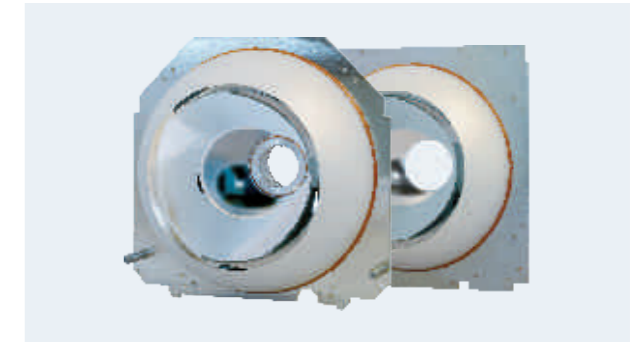
filter can be used to correct the spectrum of a xenon lamp or a metal halide lamp so that the emission spectrum of the simulator closely matches the distribution of sunlight irradiation intensity. Solar energy optical simulators are widely used in the field of detection, aging, and photochemistry. The spectral matching degree and optical efficiency can be calculated for various use conditions, and filters of various powers and grades can be matched to meet the standard requirements.

Product Type:

- Microscope LBD sunlight filter
- Total reflection ellipsoid mirror, parabolic mirror, plane mirror
- AM 1.5 filter
- UV cutoff filter
- Sunlight matching filter
- Window filter

Application:

- Sunlight simulator
- Light microscope illumination
- Environmental aging equipment
- Test equipment and photovoltaic detection
- Photochemical and photocatalytic equipment





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