colorPol® polarizers

CODIXX

colorPol® polarizers

A new polarizer family

colorPol® polarizers are dichroic glass polarizers. They feature a high contrast ratio and a high transmittance. Standard colorPol® polarizers are available for the UV wavelength range (340 – 420 nm) and for the VIS, NIR and MIR range (440 nm – 5.0 µm).
For the range of 1.2 to 2.5 µm, there are special versions of high transmittance (HT) polarizers with values up to 99%.

colorPol® polarizers

- are flat like foil polarizers
- can be processed like glass or silicon wafers
- are resistant against UV radiation and chemicals
- have large acceptance angles
- are resistant against temperatures up to +400 °C

Based on the unique colorPol® technology, CODIXX is the world's first producer of patterned polarizers.
colorPol® S polarizers have arbitrary shaped areas with different directions of polarization. Additionally, the areas can have different spectral characteristics.

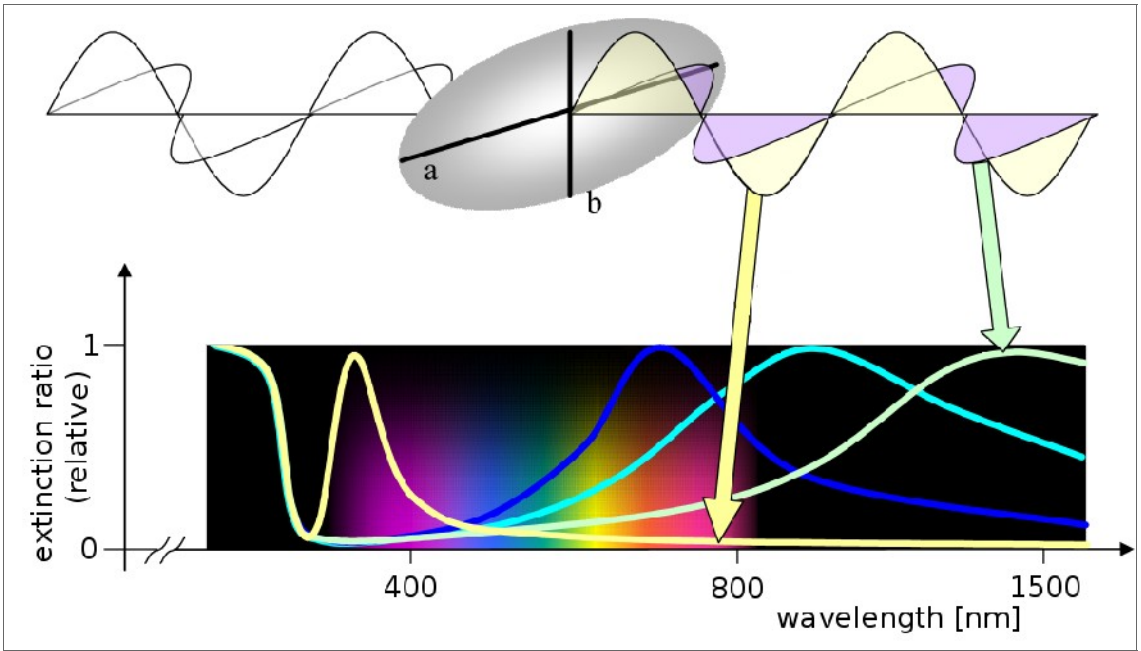
Applications

Polarizers are used in a wide range of diverse optical devices to filter or block polarized light, to modulate or reduce brightness, analyze or polarize light and lots more.
Because of their excellent properties and outstanding adaptability, colorPol® polarizers can be used in many applications like:

- Optical sensor devices
- Illumination engineering
- Instrumental filters for laboratory equipment in microscopy, ellipsometry, spectroscopy, polarimetry
- Photo elasticity, surface inspection
- Fiber dependent optical isolators
- Optical communications engineering and data storage
- Electro-optical modulators
- High-temperature LC-Displays
- High-temperature LC-Shutter
- Lyot-Filter

The colorPol® technology

With its unique technology, CODIXX is able to create uniformly oriented prolate silver nano particles in soda lime glass. The nano particles show a strong plasmon absorption, which is selective in reference to the polarization and wavelength. Beside the standard products, the flexible technology allows the production of customized polarizers with special spectral characteristics.



Absorption spectra of soda lime glass containing uniformly oriented silver particles

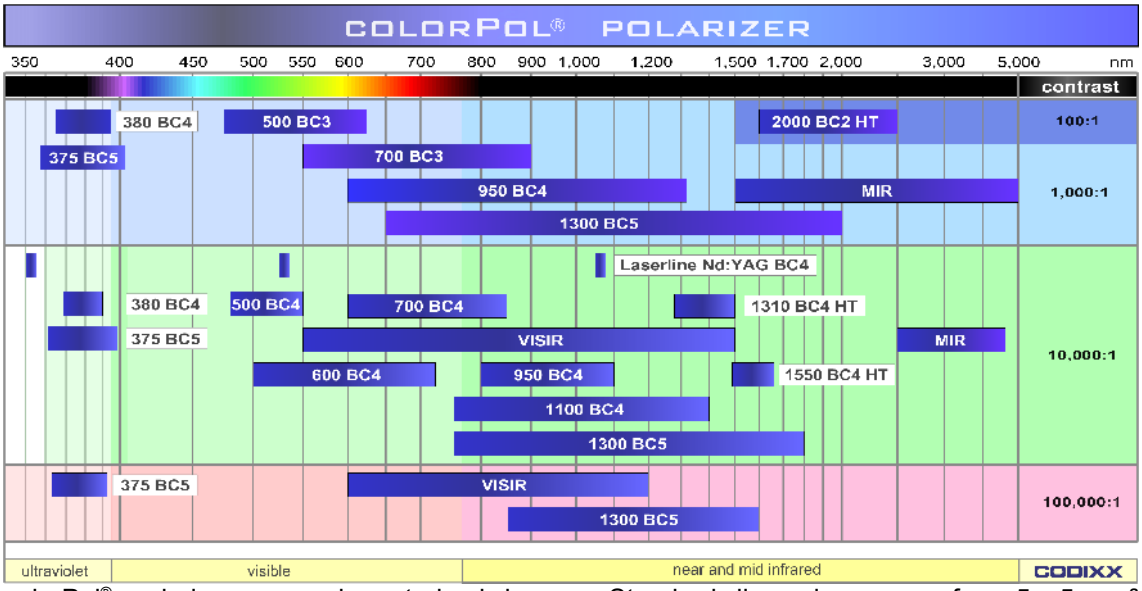
colorPol® polarizers

	Unlaminated	Laminated[1)]
Optical Parameter		
Transmitted wavefront distortion (TWD) at 633 nm over an inspection area of Ø10mm	< 3 λ	< λ/4
Beam deviation	< 20 arc min.	< 1 arc min.
Accuracy of polarization axis to indicated edge [2)]	< 0.5°	
Acceptance angle [3), 4)]	± 20°	
Refractive index at 633 nm (RI) [5)]	1.525 ± 0.005	
Cosmetic Parameter		
Surface imperfections [6)]	ISO 10110-07: 5/2 x 0.04 per Ø10mm MIL-O-13830A: S/D 40/20	
Mechanical Parameter		
Clear aperture (CA)	90% for parts < 20 x 20 mm² 95% for parts ≥ 20 x 20 mm²	
Edge chips [7)]	0.05 mm to 0.2 mm, dependent upon part size < 0.05 mm on request	
Specific weight	2.5 ± 0.1 g/mm³	
Coefficient of elasticity E	70 ± 5 kN/mm²	
Physical Parameter		
Coefficient of thermal expansion (CTE)	8.1 ± 0.3 x 10^{-6} K^{-1} (0-100°C)	
Specific heat	1.0 ± 0.1 J/gK	
Thermal conductivity	0.94 ± 0.05 W/mK	
Operation Limits		
Laser damage threshold (LDT)		
a) Continuous wave (CW)	10 W/cm² continuous block 25 W/cm² continuous pass	1 W/cm² continuous block 5 W/cm² continuous pass
b) Pulsed	12 MW/cm² pulse peak power (equivalent of about 1 µJ/cm² pulse power density)	1 MW/cm² pulse peak power (equivalent of about 100 nJ/cm² pulse power density)
Operating temperature range	up to +400°C	UV types: -20°C to +80°C all other: -20°C to +120°C
Durability		
Thermal cycle	-40°C to +80°C 200 cycles (DIN EN 60068-2-14 method Na)	
Humid storage	85°C, 85% rel. humidity, 1,000 h According to Telcordia GR-1221-CORE	
UV-stability	UV-stability 20 mW/cm² at 60 h irradiation without any degradation	
Chemical resistance	colorPol® polarizers are insensitive to most organic and cleaning solvents, acids and bases[8)] and distilled water.	

[1)] laminated, ground and polished
[2)] less tolerance available upon request
[3)] exceeding this angle may lower contrast and transmittance
[4)] AR coating may limit this angle
[5)] RI for other wavelengths on request
[6)] other quality grades available on request
[7)] other specifications available on request
[8)] AR coating limits the resistivity

colorPol® polarizers

Overview



colorPol® polarizers are characterized by their wavelength range and contrast ratio (≥ 1,000:1, ≥ 10,000:1 and ≥ 100,000:1, indicated in the product name by C3, C4 and C5 respectively).

The wavelength of maximum polarization is determined by the chosen technology parameters. The peak position can be brought in line with customer's requirements.
The wavelength range of effective polarization spans the UV region (colorPol® UV: 340 to 420 nm), the visible and infrared region (colorPol® VIS and colorPol® IR: 440 nm to 5 µm).

Standard dimensions range from 5 x 5 mm² up to 60 x 100 mm². Various thicknesses between 0.2 to 10 mm raw or laminated on a carrier glass are available.

Other dimensions and shapes are available on request.

AR-coatings:
colorPol® polarizers can be delivered with AR-coatings.

Sample sets

CODIXX offers sample sets of its polarizers for evaluation at an attractive price. Sample sets are customized compilations of either 4 or 6 polarizers out of the colorPol® standard or HT series with dimension of 10 x 10 mm². In one sample set, the maximum quantity of filters with the same type is limited to 2 pieces.
The shipment will be done within one working day after ordering.

Standard polarizers

colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio k_1: k_2 [1)]	Thickness [µm]	Dimension [mm²]
UV 375 BC5	362-392 360-397 357-403	>40-47 >40-48 >39-48		220±50	<=100x50
UV 380 BC4	372-388 369-390 365-395	>52-57 >52-58 >51-59	>100,000:1 >10,000:1 >1,000:1	220±50	<=100x50
VIS 500 BC3	475-625	>55-81	>1,000:1	280±50	<=100x60
VIS 500 BC4	480-550	>58-76	>10,000:1	280±50	<=100x60
VIS 600 BC4	500-720	>60-84	>10,000:1	280±50	<=100x60
VIS 700 BC3	550-900	>77-86	>1,000:1	220±50	<=100x50
VIS 700 BC4	600-850 600-1,000	>78-87 >78-88	>10,000:1 >1,000:1	220±50	<=100x50
VISIR	600-1,200 550-1,500	>67-84 >57-85	>100,000:1 >10,000:1	260±50	<=100x60
IR 950 BC4	800-1,100 600-1,320	>85-87 >80-88	>10,000:1 >1,000:1	220±50	<=100x50
IR 1100 BC4	900-1,200 750-1,400 650-1,700	>85-87 >83-87 >80-88	>100,000:1 >10,000:1 >1,000:1	220±50	<=100x50
IR 1300 BC5	850-1,600 750-1,800 650-2,000	>82-86 >80-87 >76-87	>100,000:1 >10,000:1 >1,000:1	220±50	<=100x50
Laserline Nd:YAG BC4	at 355 nm at 532 nm at 1,064 nm	>37 >50 >79	>10,000:1	270±50	<=100x60
MIR	2,000-4,500 1,500-5,000	>65-90 >35-90	>10,000:1 >1,000:1	200±50	<=100x50

Contrast ratios >100,000:1, other thicknesses, shapes or dimensions on request. Reflection losses can be minimized by anti-reflection coatings. AR-coatings are available for different wavelength ranges as V-coating or wide-band version.

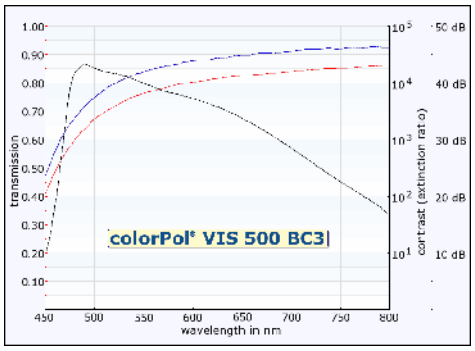
High transmittance polarizers

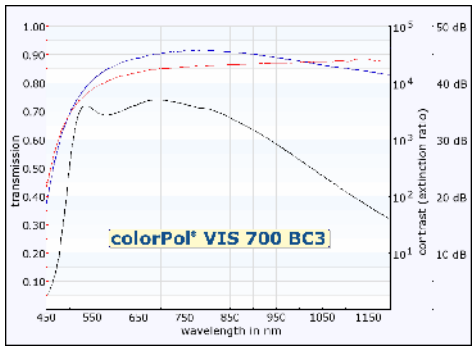
High transmittance polarizers offer a low insertion loss and high contrast ratios within the given spectral range. They are available for the spectral range of 1.2 - 2.5 µm.

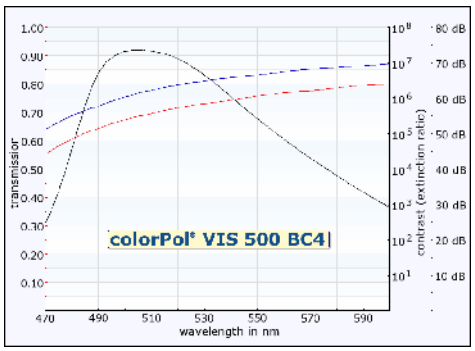
colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio k_1: k_2 [1)]	Thickness [µm]	Dimension [mm²]
IR 1310 BC4 T2 HT IR 1310 BC4 HT IR 1310 BC4 T5 HT	1,280-1,500	>88.0-90.0	>10,000:1	200 ± 50 250 ± 50 500 ± 50	<=100x50 <=100x60 <=100x28
IR 1310 BC4 T2 HT C1310 IR 1310 BC4 HT C1310 IR 1310 BC4 T5 HT C1310	1,280-1,500	>96.0-98.0 >97.0 at 1,310 nm	>10,000:1	200 ± 50 250 ± 50 500 ± 50	<=100x50 <=100x60 <=100x28
IR 1550 BC4 T2 HT IR 1550 BC4 HT IR 1550 BC4 T5 HT	1,480-1,650	>89.0-91.0	>10,000:1	200 ± 50 250 ± 50 500 ± 50	<=100x50 <=100x60 <=100x28
IR 1550 BC4 T2 HT C1550 IR 1550 BC4 HT C1550 IR 1550 BC4 T5 HT C1550	1,480-1,650	>97.0-98.5 >98.0 at 1,550 nm	>10,000:1	200 ± 50 250 ± 50 500 ± 50	<=100x50 <=100x60 <=100x28
IR 2000 BC2 HT	1,600-2,500	>90.0	>100:1	220 ± 50	<=100x50
IR 2000 BC2 HT CW06	1,600-2,500	>96.0	>100:1	220 ± 50	<=100x50

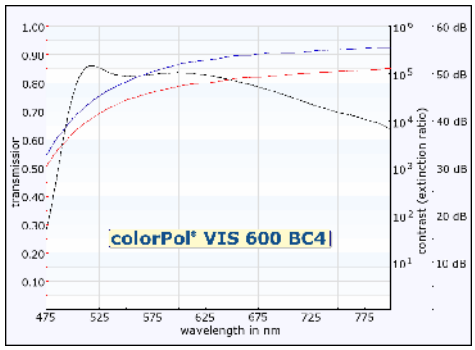
[1)] The contrast ratio is defined to be k_1/k_2, where k_1 is the transmittance beam passing the filter and k_2 is the transmittance of a polarized beam blocked by the filter.

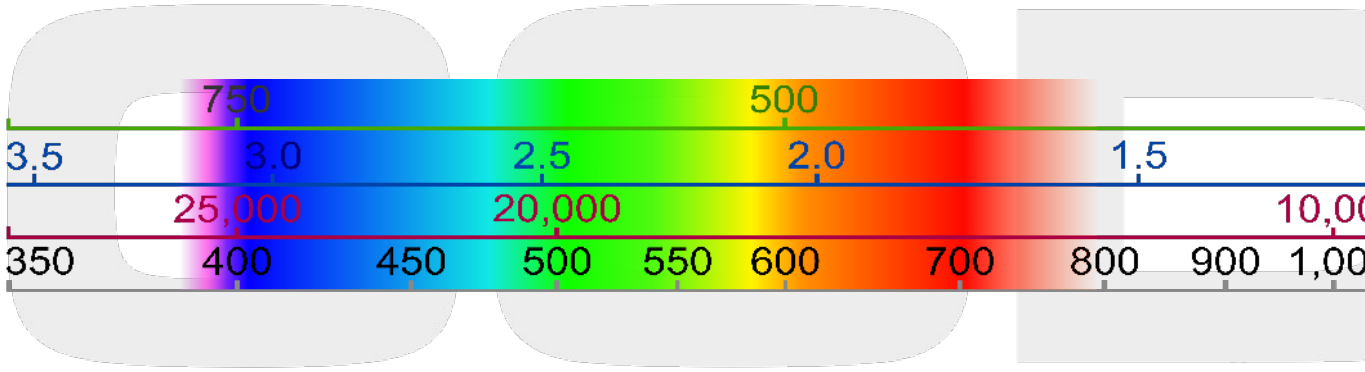
colorPol® polarizers

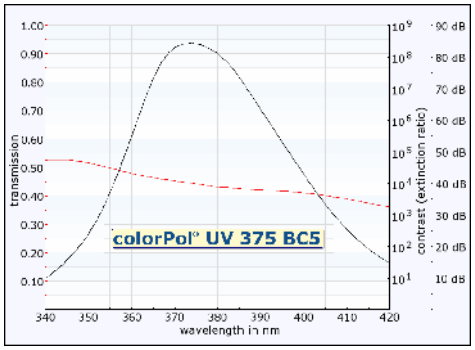


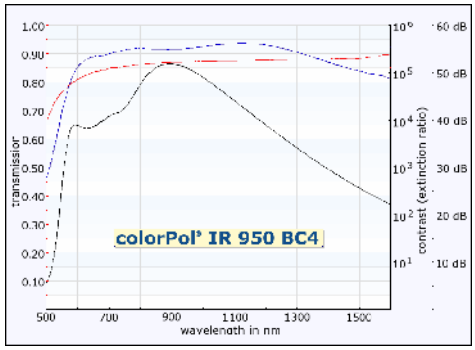


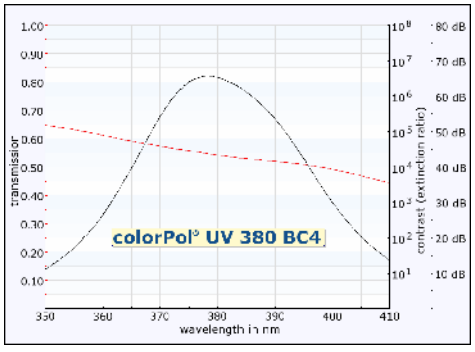


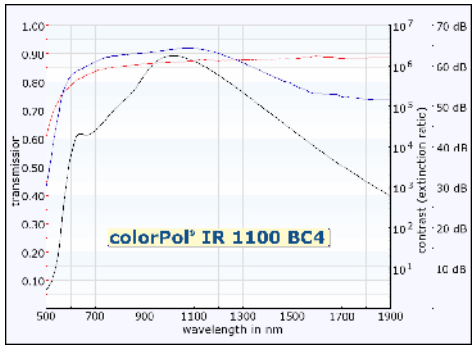


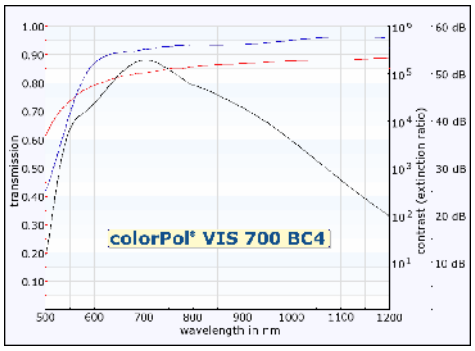


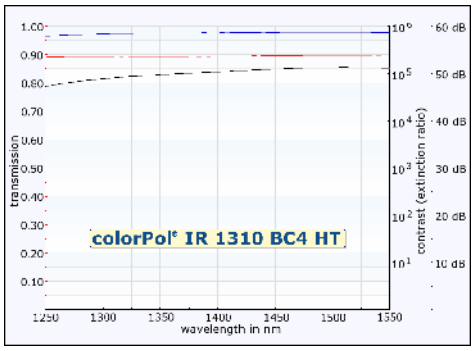


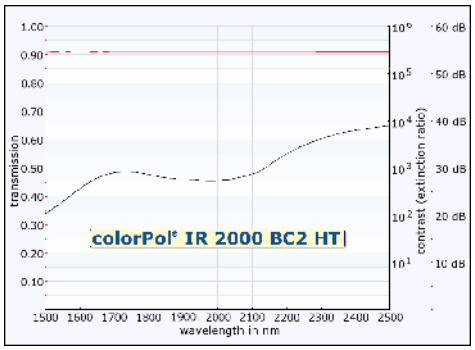


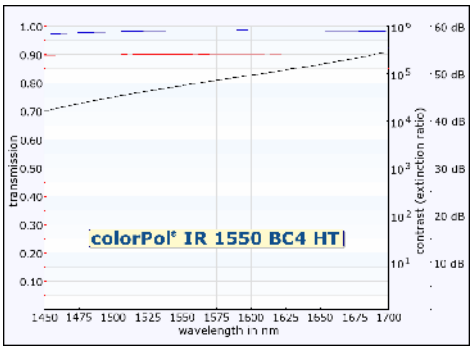


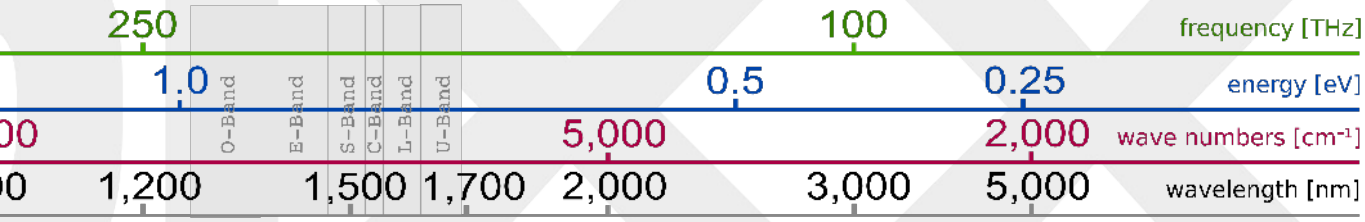


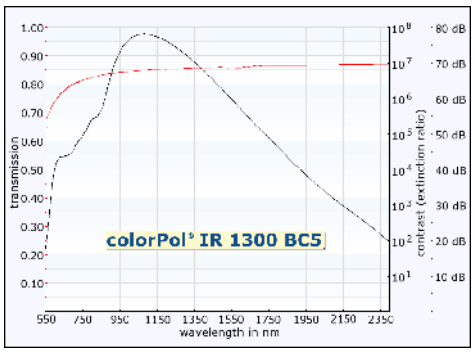


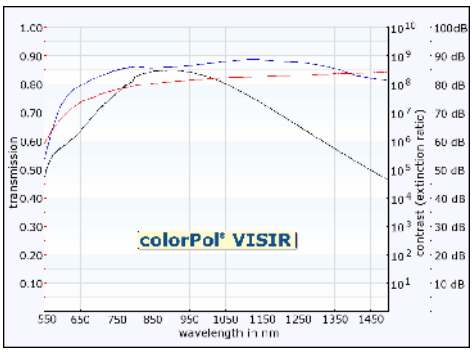


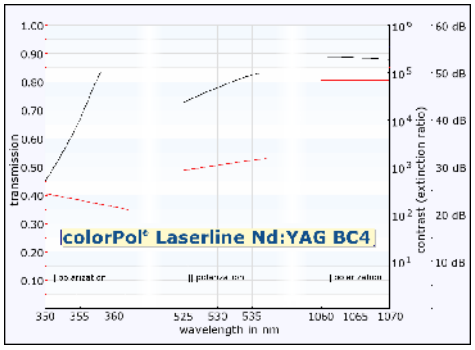


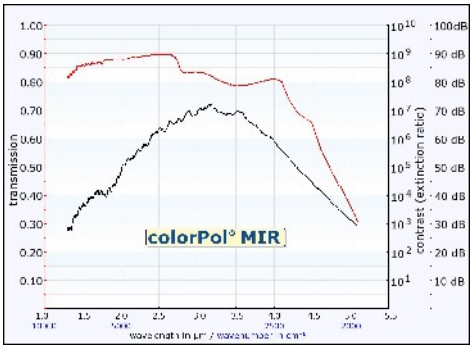












Transmittance Transmittance with antireflection coating contrast (extinction ratio)

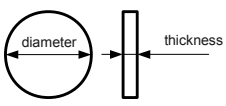
colorPol® polarizers

Standard round polarizers

colorPol® type	Wavelength range [nm] with contrast ratio[1)]			Filter thickness	
	>1,000:1	>10,000:1	>100,000:1	unlaminated	laminated
UV 375 BC5	357-403 k_1> 39-48%	360-397 k_1> 40-48%	362-392 k_1> 40-47%	220 ± 50µm	2.0 ± 0.2mm
UV 380 BC4	365-395 k_1> 51-59%	369-390 k_1> 52-58%	372-388 k_1> 52-57%	220 ± 50µm	2.0 ± 0.2mm
VIS 500 BC3	475-625 k_1> 55-81%			280 ± 50µm	2.0 ± 0.2mm
VIS 500 BC3 CW01	475-650 k_1> 62-91%			280 ± 50µm	2.0 ± 0.2mm
VIS 500 BC4		480-550 k_1> 58-76%		280 ± 50µm	2.0 ± 0.2mm
VIS 500 BC4 CW01		480-550 k_1> 65-83%		280 ± 50µm	2.0 ± 0.2mm
VIS 600 BC4		500-720 k_1> 60-84%		280 ± 50µm	2.0 ± 0.2mm
VIS 600 BC4 CW01		500-720 k_1> 65-90%		280 ± 50µm	2.0 ± 0.2mm
VIS 700 BC3	550-900 k_1> 77-86%			220 ± 50µm	2.0 ± 0.2mm
VIS 700 BC3 CW03	550-900 k_1> 84-93%			220 ± 50µm	2.0 ± 0.2mm
VIS 700 BC4	600-1,000 k_1> 78-88%	600-850 k_1> 78-87%		220 ± 50µm	2.0 ± 0.2mm
VIS 700 BC4 CW02	600-1,000 k_1> 84-95%	600-850 k_1> 84-93%		220 ± 50µm	2.0 ± 0.2mm
VISIR		550-1,500 k_1> 57-85%	800-1,100 k_1> 67-84%	260 ± 50µm	2.0 ± 0.2mm
VISIR CW02			600-1,200 k_1> 71-88%	260 ± 50µm	2.0 ± 0.2mm
IR 950 BC4	600-1,320 k_1> 80-88%	800-1,100 k_1> 85-87%		220 ± 50µm	2.0 ± 0.2mm
IR 950 BC4 CW02	600-1,320 k_1> 84-94%	800-1,100 k_1> 90-94%		220 ± 50µm	2.0 ± 0.2mm
IR 1100 BC4	650-1,700 k_1> 80-88%	750-1,400 k_1> 83-87%	900-1,200 k_1> 85-87%	220 ± 50µm	2.0 ± 0.2mm
IR 1100 BC4 CW02	650-1,700 k_1> 86-93%	750-1,400 k_1> 90-93%	900-1,200 k_1> 91-93%	220 ± 50µm	2.0 ± 0.2mm
IR 1300 BC5	650-2,000 k_1> 76-87%	750-1,800 k_1> 80-87%	850-1,600 k_1> 82-86%	220 ± 50µm	2.0 ± 0.2mm
Laserline Nd:YAG BC4		355, 532, 1,064 k_1>37, 50, 79%		270 ± 50µm	2.0 ± 0.2mm
MIR	1,500-5,000 k_1> 35-90%	2,000-4,500 k_1> 65-90%		200 ± 50µm	

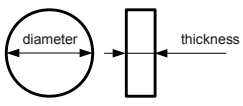
[1)] The contrast ratio is defined to be k1/k2, where k1 is the transmittance beam passing the filter and k2 is the transmittance of a polarized beam blocked by the filter.

Standard polarizers



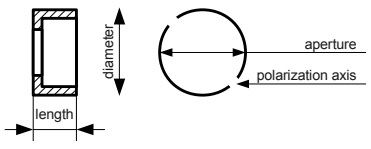
Diameter [mm]	Clear aperture [mm]
12.5 - 0.2	11.2
12.7 - 0.2 (½")	11.4
25.0 - 0.2	22.5
25.4 - 0.2 (1")	22.9

Laminated round polarizers



Diameter [mm]	Thickness [mm]	Clear aperture [mm]
12.5 - 0.2	2.0 ± 0.2	11.2
25.0 - 0.2	2.0 ± 0.2	22.5
wavefront distortion < λ/4 at 633 nm		

Mounted polarizers



Diameter [mm]	Clear aperture [mm]	Length [mm]
12.5 e8	8.1	5 or 7
12.7 (1/2") e8	8.1	5 or 7
25.0 e8	20.8	5 or 10
25.4 (1") e8	20.8	5 or 10

Other diameters are available on request.

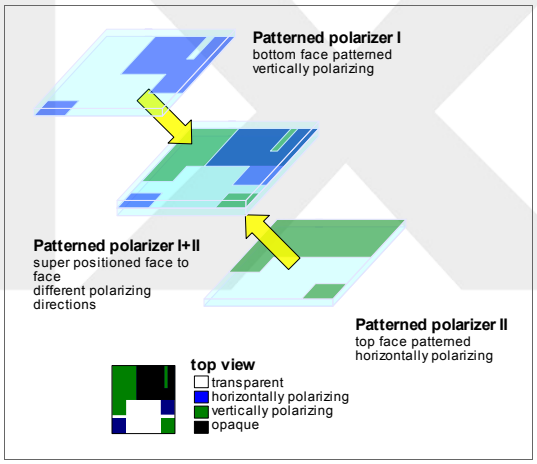
Patterned polarizers

In difference to a common linear polarizer, which provides the same optical properties over the whole clear aperture, a patterned polarizer is subdivided into segments. The segments may have different optical properties like the orientation of the polarization axis or wavelength range, or can be opaque or transparent. Size, shape and number of segments with different optical properties determine which of CODIXX's unique manufacturing technology is applicable.

Lithographical technology

The polarization of colorPol® polarizers is caused by elongated silver nano particles, which are embedded into the glass only in a shallow depth. This specific design offers the possibility to remove these nano particles by surface etching. With lithography, this can be done selectively.

A patterned polarizer with regions of either transparent or linear polarizing properties is the result. The shape of the regions can be randomly chosen, the resolution can be as high as 30 µm at still reasonable costs. The polarization axis of all regions as well as the wavelength range is same.



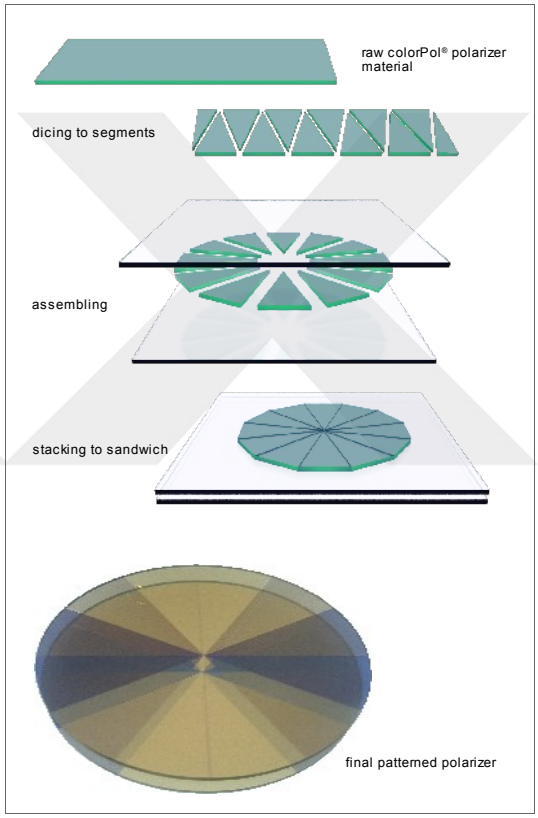
To create a polarizer with regions of different polarization axes, at least two of the polarizers, which were patterned as described above, must be stacked on top of each other (see sketch above). The more different orientations of the polarization axis are needed, the more planes must be stacked. The different height positions of the planes may cause a parallax.

If used as an analyzer, the scattering of the nano particles may lead to a decrease of the polarizers contrast and some crosstalk in rare cases.

Mosaic technology

colorPol® is well suited for this classical method of manufacturing patterned polarizers. The thin glass substrates can be diced precisely with for example wafer saws.

Different polarization directions as well as different wavelength ranges can be chosen for each segment. On the other hand, the size, shape and number of segments is limited.



After the precise side-by-side arrangement, the mosaic is sandwiched between two carrier substrates.

colorPol® polarizers

CODIXX

CODIXX is a German share holder company founded in 1998.
Alter a period of technology development and building up the production equipment, CODIXX has started the production of a new family of dichroic glass polarizers in 2002.
The production line is located in Barleben near Magdeburg. Since the end of 2002 the company has been manufacturing standard and customized polarizers for a variety of applications.


CERTIFICATE

TÜV CERT

Management system as per
DIN EN ISO 9001 : 2000

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development, production & sales of polarisers

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