CODIXX

LASER COMPONENTS

colorPol® polarizers
the polarizer family Made in Germany

Applications

- Optical Communications
- Semiconductors
- Measurement Instrumentations
- Display Industries
- Medical Industries
- Laboratories
- R&D
- Space Industries
- Projectors
- ... and many more

CODIXX

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LASER COMPONENTS

colorPol® polarizers

The colorPol® family

colorPol® polarizers are dichroic glass polarizers, made from a highly durable soda-lime glass containing silver nanoparticles. Like all dichroic polarizers they let the desired polarized light pass and absorb the unwanted polarization. Different types of polarizers are available to suit a wide field of applications operating at UV wavelength range (340 nm - 420 nm) and VIS, NIR and MIR wavelength range (440 nm - 5.0 µm).

All polarizers can be processed like glass or silicon wafers, while being thin like foil polarizers. UV radiation and most chemicals cause no damage. They have a large acceptance angle of ± 20° and a high accuracy of polarization axis to edge.

Standard colorPol® polarizer **UV VIS NIR MIR**

- Transmittance up to 95% (with anti-reflection(AR)-coating)
- Ultraviolet, visible, near infrared and mid infrared versions avaible
- Temperature resistant between -50°C and +400°C
- Most economical choice for linear polarizer

High Transmittance colorPol® HT polarizer UV VIS **NIR** MIR

- Transmittance up to 96% (with AR-coating)
- Available for wavelengths around 1310 nm, 1490 nm or 1550 nm
- High contrast ratio
- Thicknesses of 0.20 mm, 0.27 mm and 0.50 mm

Patterned colorPol® S polarizer **UV VIS NIR** MIR

- Subdivided into segments
- Serveral polarization axes or wavelength ranges within one polarizer
- Opaque or transparent segments possible
- Unique manufacturing technology (see page 8)

Narrowband colorPol® N polarizer UV VIS **NIR** MIR

- Contrast ratio over 10 000:1 (40 dB)
- Transmittance > 96% (with AR-coating)
- Optimized for one wavelength ±30 nm
- Developed for laser applications at 1310 nm, 1490 nm and 1550 nm
- Thickness around 0.2 mm

colorPol® Laserline Nd:YAG polarizer **UV VIS NIR** MIR

- Covers the laser wavelengths 355 nm, 532 nm and 1064 nm
- Contrast ratio over 10 000:1 (40 dB)
- Polarization axis at 355 nm perpendicular to 532 nm and 1064 nm
- Unique all-in-one polarizer - no filterchange necessary

Extra thin colorPol® Xtrafine polarizer UV VIS **NIR** MIR

- Thickness of only 25 µm
- Available for the spectral range of 1260 nm - 1680 nm

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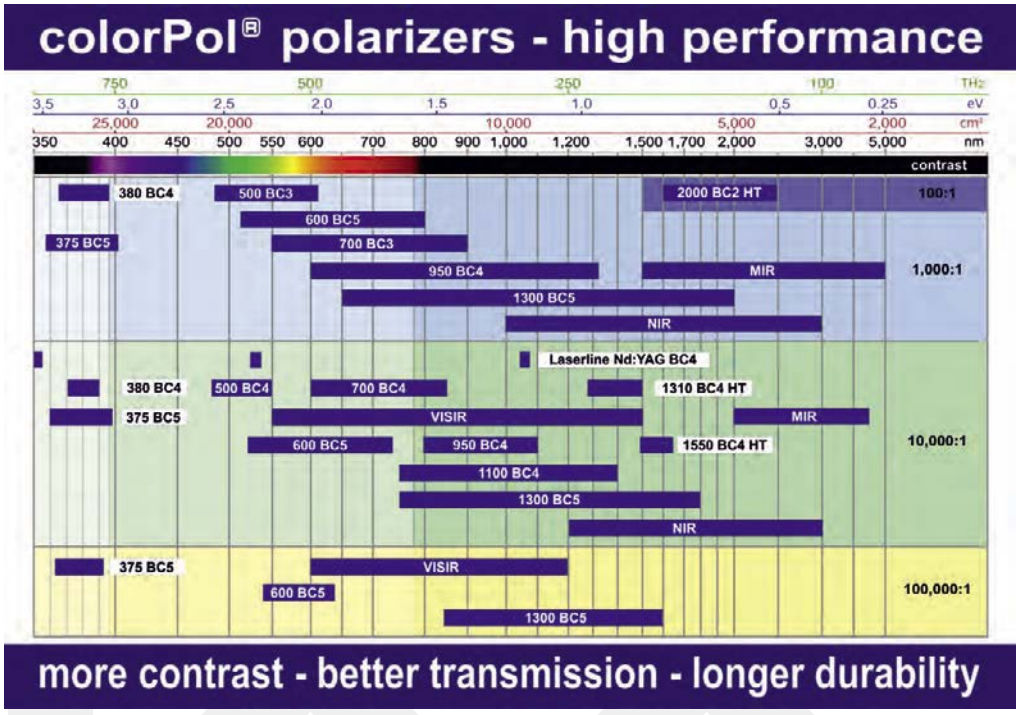
colorPol® polarizers

Available wavelengths



Customization options

Size: Up to 100 x 60 mm² as one piece

Shape: Square, circle, ring, octahedron, ...

Polarization axis: Any defined angle to chosen edge

Lamination: One or both sides
- Transmitted wavefront distortion (TWD) < λ/4 (at 633 nm over Ø10 mm)
- Beam deviation < 1 arc min.
- Reduced temperature resistance
- Standard thickness between 0.8 mm and 2.0 mm
- Other thicknesses are available upon request

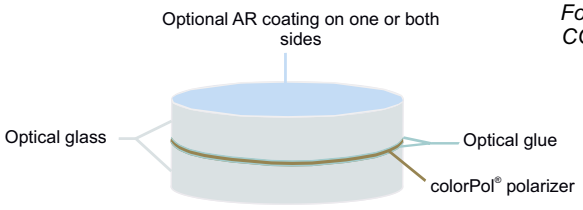
Anti-Reflection coating: One or both sides
- Increased transmittance
- Reduced reflections

Marked polarization axis: On polarizer or mount

Mounted
- Better handling

Wavelength range of peak polarization:
- Wavelength range of polarisation can be customized within the covered wavelength range (340 nm - 420 nm, 440 nm - 5.0 µm)

For any other special requirements, please contact CODIXX or your local distributor.



Schematic contruction of a laminated colorPol® polarizer

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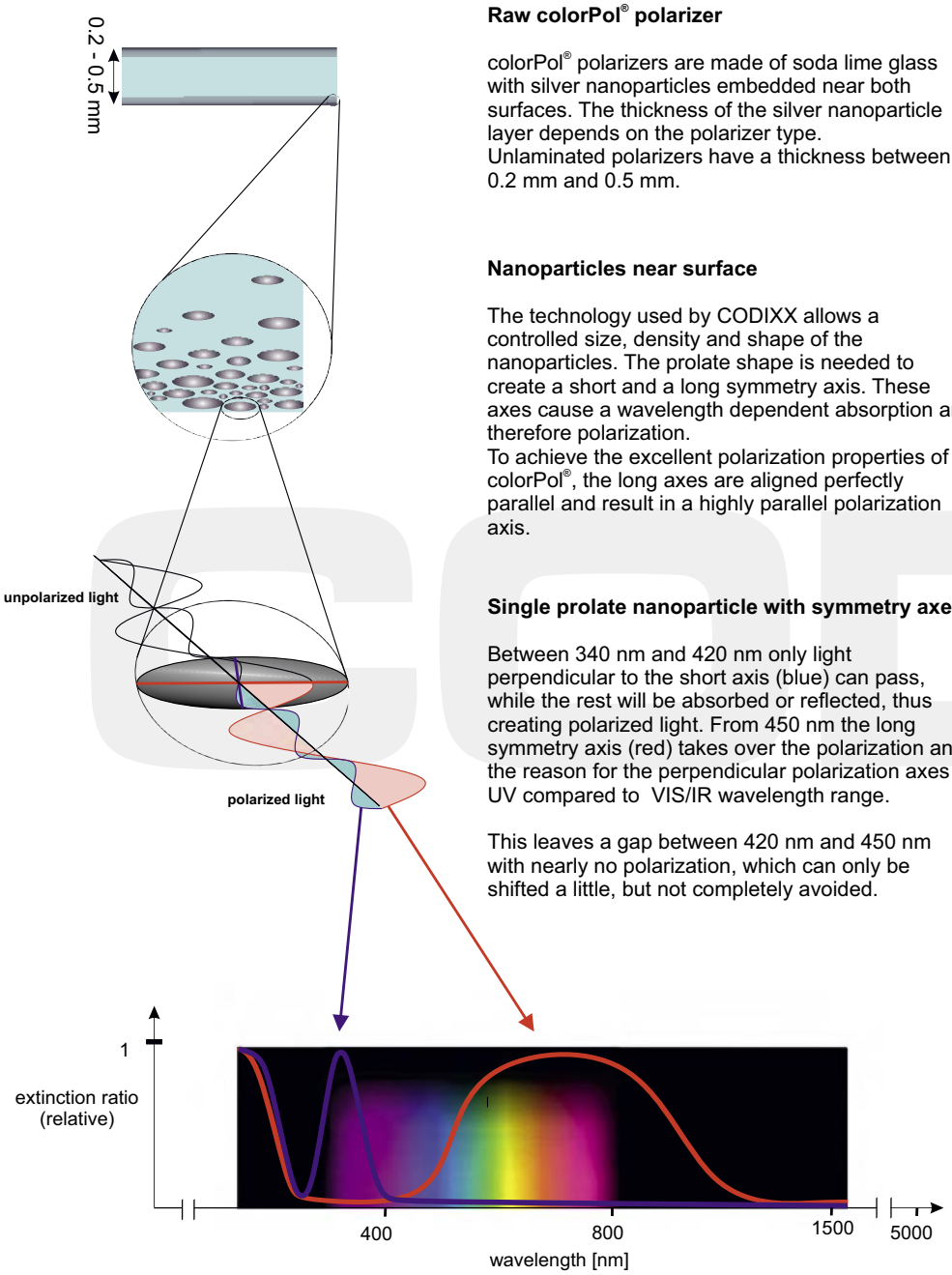
colorPol® polarizers

The unique colorPol® technology



Schematic absorption spectra of soda lime glass containing uniformly oriented silver nanoparticles

Raw colorPol® polarizer

colorPol® polarizers are made of soda lime glass with silver nanoparticles embedded near both surfaces. The thickness of the silver nanoparticle layer depends on the polarizer type.
Unlaminated polarizers have a thickness between 0.2 mm and 0.5 mm.

Nanoparticles near surface

The technology used by CODIXX allows a controlled size, density and shape of the nanoparticles. The prolate shape is needed to create a short and a long symmetry axis. These axes cause a wavelength dependent absorption and therefore polarization.
To achieve the excellent polarization properties of colorPol®, the long axes are aligned perfectly parallel and result in a highly parallel polarization axis.

Single prolate nanoparticle with symmetry axes

Between 340 nm and 420 nm only light perpendicular to the short axis (blue) can pass, while the rest will be absorbed or reflected, thus creating polarized light. From 450 nm the long symmetry axis (red) takes over the polarization and the reason for the perpendicular polarization axes of UV compared to VIS/IR wavelength range.

This leaves a gap between 420 nm and 450 nm with nearly no polarization, which can only be shifted a little, but not completely avoided.

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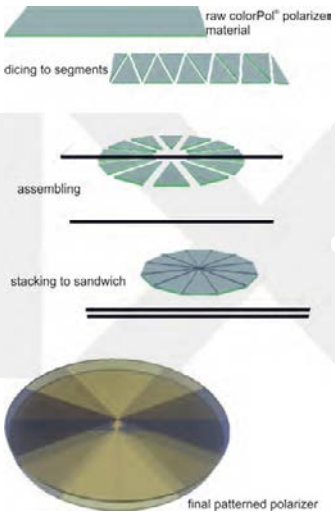
colorPol® polarizers

Patterned polarizers

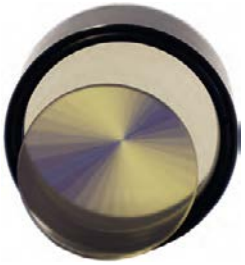
In difference to a common linear polarizer, which provides the same optical properties over the whole clear aperture, a patterned polarizer is subdivided into segments. The segments may have different optical properties like the orientation of the polarization axis or wavelength range, or can be opaque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

Mosaic technology

colorPol® is well suited for this classical method of manufacturing patterned polarizers. Different polarization directions as well as different wavelength ranges can be chosen for each segment. The size, shape and number of segments is limited due to the production process.



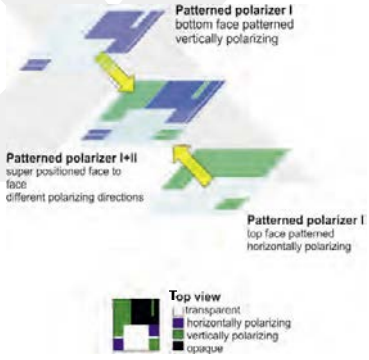
The thin glass polarizers are diced precisely, for example with wafer saws. The single pieces are assembled carefully in the desired order. Lastly, the whole mosaic is sandwiched between two carrier substrates.



Lithographical technology

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

A patterned colorPol® polarizer with regions of either transparent or linear polarizing properties is the result. The shape of these 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.

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colorPol® polarizers

Standard polarizers

colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio $k_1:k_2$ [1]	Thickness unlaminated [µm]	Thickness laminated [mm]	Maximum dimension [mm x mm]
UV 375 BC5	362 - 392 360 - 397 357 - 403	>40-47 >40-48 >39-48	>100 000:1 >10 000:1 >1 000:1	220±50	2.0±0.2	<=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	2.0±0.2	<=100x50
VIS 500 BC3	475 - 625	>55-81	>1 000:1	280±50	2.0±0.2	<=100x60
VIS 500 BC3 CW01 (AR coated)	475 - 625	>58-90	>1 000:1	280±50	2.0±0.2	<=100x60
VIS 500 BC4	480 - 550	>58-76	>10 000:1	280±50	2.0±0.2	<=100x60
VIS 500 BC4 CW01 (AR coated)	480 - 550	>62-82	>10 000:1	280±50	2.0±0.2	<=100x60
VIS 600 BC5	530 - 640 520 - 720 510 - 800	>62-78 >60-81 >55-83	>100 000:1 >10 000:1 >1 000:1	280±50	2.0±0.2	<=100x60
VIS 600 BC5 CW01 (AR coated)	530 - 640 520 - 740 510 - 750 [800]	>66-83 >63-86 >58-86	>100 000:1 >10 000:1 >1 00:1	280±50	2.0±0.2	<=100x60
VIS 700 BC3	550 - 900	>77-86	>1 000:1	220±50	2.0±0.2	<=100x50
VIS 700 BC3 CW03 (AR coated)	550 - 900	>84-93	>1 000:1	220±50	2.0±0.2	<=100x50
VIS 700 BC4	600 - 850 600 - 1 000	>78-87 >78-88	>10 000:1 >1 000:1	220±50	2.0±0.2	<=100x50
VIS 700 BC4 CW02 (AR coated)	600 - 850 600 - 1 000	>84-93 >84-95	>10 000:1 >1 000:1	220±50	2.0±0.2	<=100x50
VISIR	600 - 1 200 550 - 1 500	>67-84 >57-85	>100 000:1 >10 000:1	260±50	2.0±0.2	<=100x60
VISIR CW02 (AR coated)	600 - 1 200	>71-88	>100 000:1	260±50	2.0±0.2	<=100x60
IR 950 BC4	800 - 1 100 600 - 1 320	>85-87 >80-88	>10 000:1 >1 000:1	220±50	2.0±0.2	<=100x50
IR 950 BC4 CW02 (AR coated)	800 - 1 100 600 - 1 150	>90-94 >82-94	>10 000:1 >1 000:1	220±50	2.0±0.2	<=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	2.0±0.2	<=100x50
IR 1100 BC4 CW02 (AR coated)	900 - 1 200 750 - 1 250 650 - 1 250	>91-94 >89-94 >86-94	>100 000:1 >10 000:1 >1 000:1	220±50	2.0±0.2	<=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	2.0±0.2	<=100x50
NIR	1 000 - 2 700 2 700 - 3 000 1 200 - 3 000 1 000 - 3 000	>77 >70	>10 000:1 >1 000:1	250±65	2.0±0.2 at other wavelength ranges [2]	<=100x60
MIR	2 000 - 4 500 1 500 - 5 000	>65-90 >35-90	>10 000:1 >1 000:1	200±50		<=100x50

[1] The contrast ratio is defined to be k_1/k_2, where k_1 is the transmittance of a polarized beam passing the filter and k_2 is the transmittance of a polarized beam blocked by the filter.
[2] Wavelength range up to 2 650 nm and with modified transmittance

Contrast ratios >100 000:1, other thicknesses, shapes or dimensions available on special 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.

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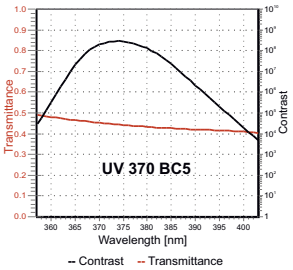
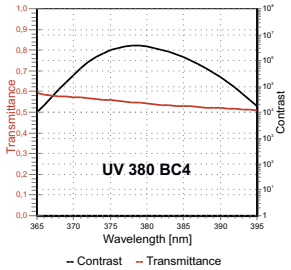
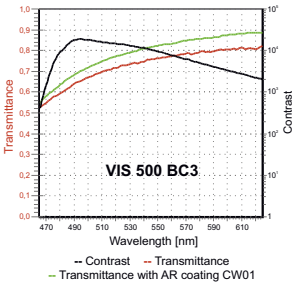
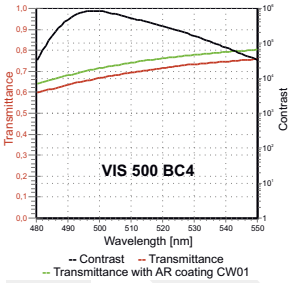
colorPol® polarizers

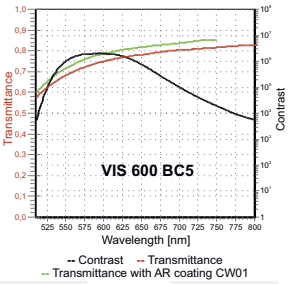
Typical perfomance of standard polarizers

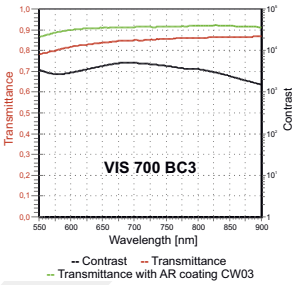


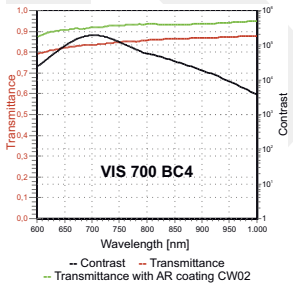


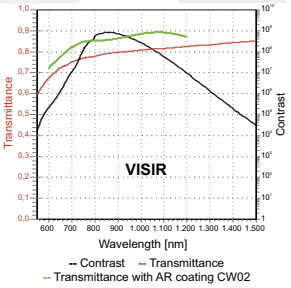


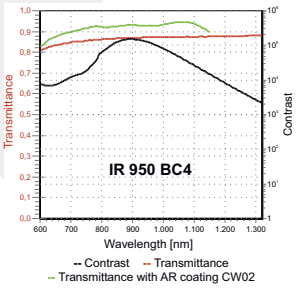


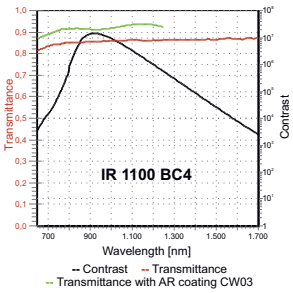


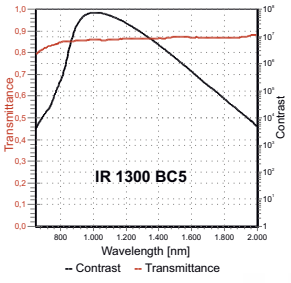


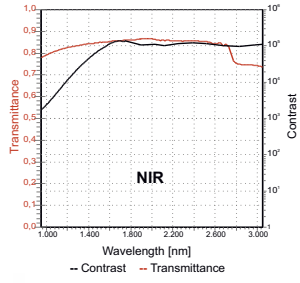


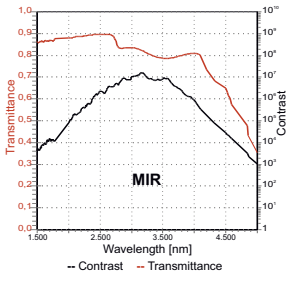












The graphs should be considered typical only.
Guaranteed values are given in the corresponding table on the previous page.

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LASER COMPONENTS

colorPol® polarizers

High transmittance polarizers

colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio $k_1:k_2$ [1]	Thickness unlaminated [µm]	Thickness laminated [mm]	Maximum dimension [mm x mm]
IR 1310 BC4 HT	1 280 - 1 500	>88	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1310 BC4 HT (laminated)	1 280 - 1 500	>87	>10 000:1	-	2.0±0.2	<=100x60
IR 1310 BC4 HT C1310 (AR coated)	1 280 - 1 500	>96	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1310 BC4 HT C1310 (AR coated, laminated)	1 280 - 1 500	>95	>10 000:1	-	2.0±0.2	<=100x60
IR 1490 BC4 HT	1 450 - 1 530	>88	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1490 BC4 HT (laminated)	1 450 - 1 530	>87	>10 000:1	-	2.0±0.2	<=100x60
IR 1490 BC4 HT C1490 (AR coated)	1 450 - 1 530	>96	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1490 BC4 HT C1490 (AR coated, laminated)	1 450 - 1 530	>95	>10 000:1	-	2.0±0.2	<=100x60
IR 1550 BC4 HT	1 480 - 1 650	>88	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1550 BC4 HT (laminated)	1 480 - 1 650	>87	>10 000:1	-	2.0±0.2	<=100x60
IR 1550 BC4 HT C1550 (AR coated)	1 480 - 1 650	>96	>10 000:1	200±50 270±50 $500_{+20/-80}$	-	<=100x50 <=100x60 <=100x27
IR 1550 BC4 HT C1550 (AR coated, laminated)	1 480 - 1 650	>95	>10 000:1	-	2.0±0.2	<=100x60
IR 2000 BC2 T2 HT	1 600 - 2 500 1 550 - 1 500	>90	>100:1	200±50	-	<=100x50
IR 2000 BC2 T2 HT (laminated)	1 600 - 2 150 2 150 - 2 500	>82 >62	>100:1	-	2.0±0.2	<=100x50
IR 2000 BC2 T2 HT CW06 (AR coated)	1 600 - 2 500	>96	>100:1	200±50	-	<=100x50
IR 2000 BC2 T2 HT CW06 (AR coated, laminated)	1 600 - 1 650 1 650 - 1 850 1 850 - 2 150 2 150 - 2 500	>96 >90 >93 >70	>100:1	-	2.0±0.2	<=100x50

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

Contrast ratios >100,000:1, other thicknesses, shapes or dimensions available on special 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.

CODIXX AG reserves the right to change technical information without notice.

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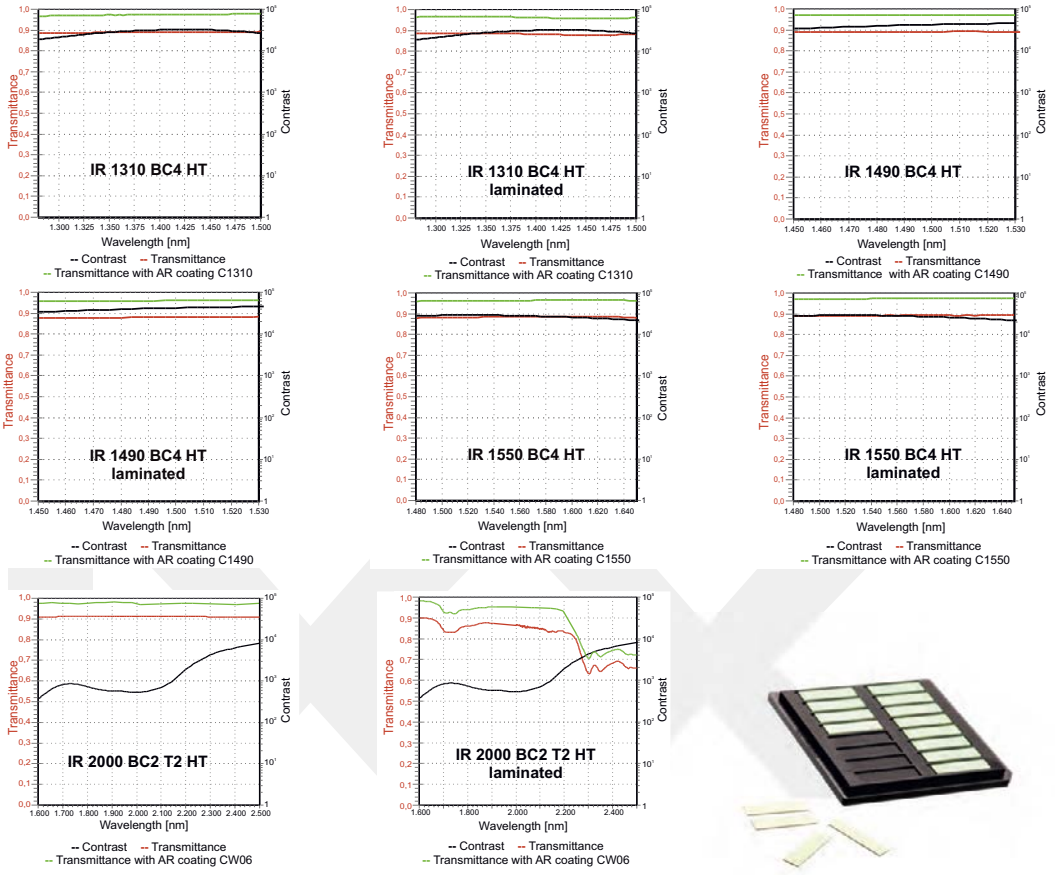
colorPol® polarizers

Typical perfomance of high transmittance polarizers



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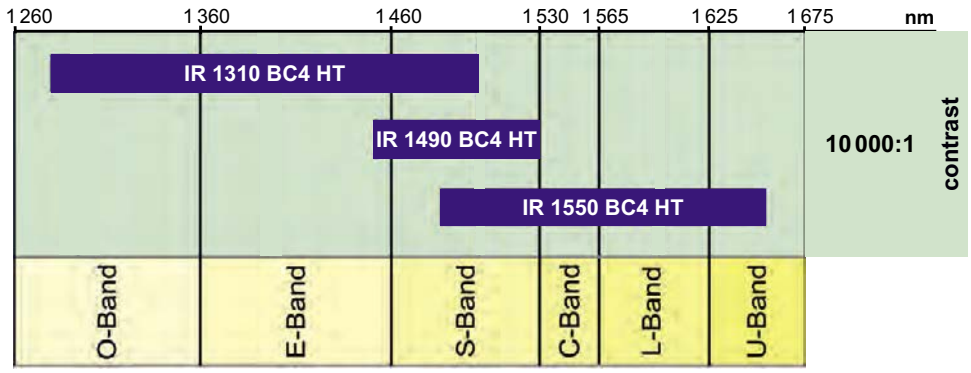

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colorPol® polarizers

colorPol® N

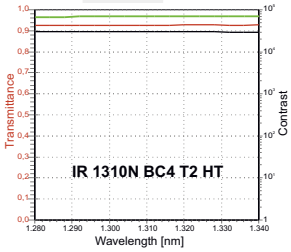
colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio $k_1:k_2$ [1]	Thickness [µm]	Maximum dimension [mm x mm]
IR 1310N BC4 T2 HT CS1310 (single side AR-coated)	1 280 - 1 340	>92	>10 000:1	200±50	<=100x50
IR 1310N BC4 T2 HT C1310 (AR-coated)	1 280 - 1 340	>96	>10 000:1	200±50	<=100x50
IR 1490N BC4 T2 HT CS1490 (single side AR coated)	1 460 - 1 520	>92	>10 000:1	200±50	<=100x50
IR 1490N BC4 T2 HT C1490 (AR-coated)	1 460 - 1 520	>96	>10 000:1	200±50	<=100x50
IR 1550N BC4 T2 HT CS1550 (single side AR coated)	1 520 - 1 580	>92	>10 000:1	200±50	<=100x50
IR 1550N BC4 T2 HT C1550 (AR-coated)	1 520 - 1 580	>96	>10 000:1	200±50	<=100x50

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

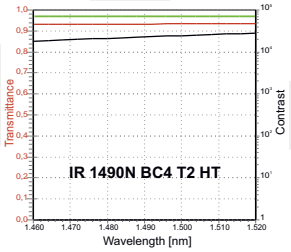
Contrast ratios >100 000:1, other thicknesses, shapes or dimensions available on special request. Reflection losses can be minimized by anti-reflection-coatings.

CODIXX AG reserves the right to change technical information without notice.

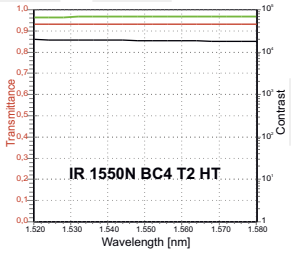
Typical perfomance of narrowband polarizers



-- Contrast
-- Transmittance with single side AR-coating CS1310
-- Transmittance with double side AR-coating C1310



-- Contrast
-- Transmittance with single side AR-coating CS1490
-- Transmittance with double side AR-coating C1490



-- Contrast
-- Transmittance with single side AR-coating CS1550
-- Transmittance with double side AR-coating C1550

The graphs should be considered typical only. Guaranteed values are given in the tables above.

Laserline Nd:YAG BC4

colorPol® type	Wavelength [nm]	Transmittance [%]	Contrast ratio $k_1:k_2$ [1]	Thickness unlaminated [µm]	Thickness laminated [mm]	Maximum dimension [mm x mm]
Laserline Nd:YAG BC4	355 nm 532 nm 1 064 nm	>37 >50 >79	>10 000:1	270±50	2.0±0.2	<=100x27

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

Other thicknesses, shapes or dimensions available on special request.

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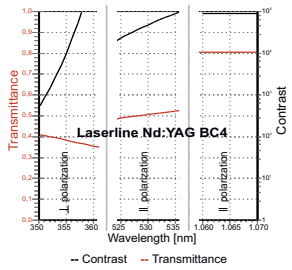
colorPol® polarizers

Typical perfomance of Laserline Nd:YAG BC4



The graph should be considered typical only.
Guaranteed values are given in the tables above.

colorPol® Xtrafine

colorPol® type	Wavelength range [nm]	Transmittance [%]	Contrast ratio k_1:k_2 [1]	Thickness [µm]	Maximum dimension [mm x mm]
Xtrafine	1 260 - 1 530	>88	>1 000:1	25 ± 10	on request
Xtrafine	1 450 - 1 680	>89	>1 000:1	25 ± 10	on request

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

Other shapes or dimensions available on special request.

CODIXX AG reserves the right to change technical information without notice.

Sample Set

CODIXX offers sample sets 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. Polarizers of the sample set are only avaible with the dimension of 10 x 10 mm². In one sample set, the maximum quantity of filters of the same type is limited to 2 pieces.

The shipment can be made within one working day after receipt of order.

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colorPol® polarizers

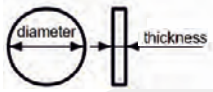
Mounted polarizers

colorPol® polarizers are available as mounted polarizers with the following standard mounts.

Other diameters are available on request.

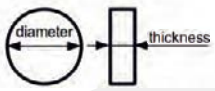
Due to the used glue, mounted polarizers have the same temperature resistance as laminated polarizers.

Standard round polarizer



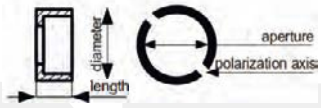
Diameter [mm]	Clear aperture [mm]
12.5 12.7	11.2 11.4
25.0 25.4	22.5 22.9

Laminated round polarizer



Diameter [mm]	Thickness [mm]	Clear aperture [mm]
12.5 25.0	2.0±0.2 2.0±0.2	11.2 22.5
Transmitted wavefront distortion < λ/4 at 633 nm per Ø 10 mm for polished parts		

Mounted round polarizer



Diameter [mm]	Clear aperture [mm]	Length [mm]
12.5 e8 12.7 e8	8.1 8.1	5 or 7 5 or 7
25.0 e8 25.4 e8	20.8 20.8	5 or 10 5 or 10

Technical specifications of colorPol®

	Unlaminated	Laminated [1]
Optical Parameter		
Transmitted wavefront distortion (TWD) at 633 nm over an inspection area of Ø10 mm	< 3 λ	< λ/4
Beam deviation	< 20 arc min.	< 1 arc min.
Accuracy of polarization axis to edge [2]	< 0.5°	
Acceptance angle [3], [4]	± 20°	
Refractive index at 633 nm (RI)[5]	1.520 ± 0.005	
Cosmetic Parameter		
Usual surface quality (in dependence on MIL-O-13830: Scratch / Dig) [6]	40/20	

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colorPol® polarizers

	Unlaminated	Laminated [1]
Mechanical Parameter		
Clear aperture (CA)	80% for parts < 2 x 2 mm² 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/cm²	
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	-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	20 mW/cm² at 60 h irradiation without any degradtion	
Chemical resistance	colorPol® polarizers are insensitive to most organic and cleaning solvents, acids and bases[8] and distilled water.	

colorPol® polarizers follow completely the international RoHS, REACH and PFOS regulations.

[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 may limit the resistivity

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LASER COMPONENTS

colorPol® polarizers

About CODIXX

CODIXX is a corporation under German Law, established in September 1998. After a period of research and development CODIXX started the production of a new family of dichroic glass polarizers in 2002.
The manufacturing plant is located in Barleben near Magdeburg. Since the end of 2002 the company is dedicated to development, production and marketing of dichroic glass polarizers, distributed worldwide under the trade name colorPol®.

Based on an unique technology for production and treatment of nano-particles in glass, CODIXX manufactures high-quality polarizers for ultraviolet, visible and infrared spectral range.

An excellent flexibility of the colorPol® technology allows for the production of customized polarizers meeting demands for all spectral ranges, contrast conditions and designs.

CODIXX follows the Quality Management System DIN EN ISO 9001:2015 to guarantee highest quality standard.The QMS was certified by TÜV Nord CERT in August 2003. In August 2018 the company was certified according the new DIN EN ISO 9001:2015, which is now valid until 2021.

colorPol® polarizers completely follow the international regulations of RoHS, REACH and PFOS.


TÜV NORD
CERTIFICATE
Management system as per
DIN EN ISO 9001 : 2015
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Germany
CODIXX
Development, production & sales of polarisers
IAF
DAkkS

Version 08/2018

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