LASER COMPONENTS®

Dichroic Mirror Coatings

Description

Dichroic mirrors are used to combine beams or to split two beams that have different wavelengths. With a long-pass mirror, the long wavelengths are transmitted and the short ones reflected. Short-pass mirrors allow the short wavelengths to pass and reflect the long ones.

Dichroic mirrors with a dielectric coating can be manufactured for wavelengths from 248 nm – 3000 nm and for angles of incidence of 0° or 45°. Other angles of incidence, angle ranges, and wavelength ranges can be produced upon request.

The following "golden rules" can help you find the best combination for your application:

- **Bandwidth**
  The bandwidth for the reflected part of the beam is limited. For the best possible beam separation or combination, it is important to allow a wavelength range to be transmitted and individual wavelengths to be reflected.
  Examples: HR1064HT400-700
  HR355HT532+1064
- **Polarization**
  The absolute degree of reflection is higher for s-polarized light than it is for p-polarized light. For transmission the relationship is the exact opposite. Therefore, keep the polarizations in your assembly in mind.
- **Reflection better than transmission**
  The reflection of a beam is more efficient. If you require greater efficiency at a certain wavelength for your application, consider this when selecting a mirror.
- **Beam combination of SHG, THG, ...**
  A reflection peak is generated at the corresponding λ/2, λ/3, ... parts of the reflected wavelength. A long-pass coating should be the preferred choice for this combination.
  Example:
  Instead of an HR1064+532HT355 coating, an HR355HT532+1064 coating would be preferred.

10/21 / V4 / HB-IF / lc-optics/coatings/dichroicmirrors

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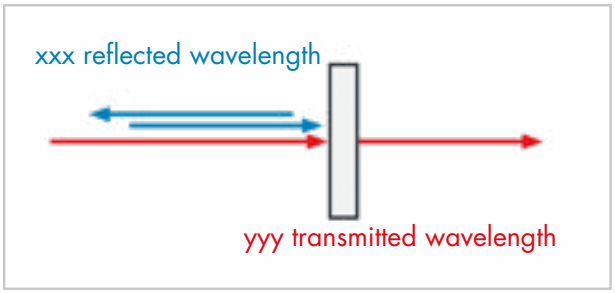
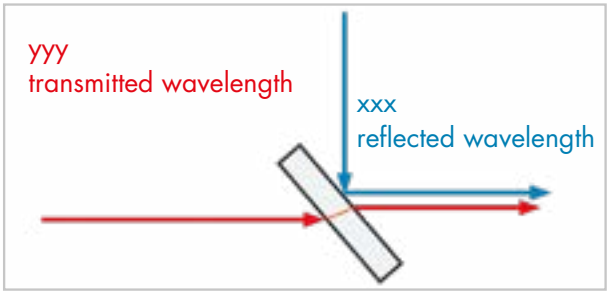
The coatings for short-pass and long-pass mirrors are primarily applied to BK7 substrates. Fused silica substrates are used for lasers with high power densities or if the wavelength of the laser is less than 380 nm or more than 2000 nm. Sapphire is used for 2.94 µm lasers.

HRxxxHTyyy/0°



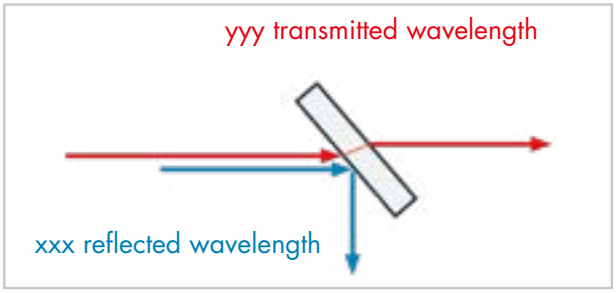
Beam separator

HRxxxHTyyy/45°



Beam combiner

HRxxxHTyyy/45°



Beam separator

Nomenclature

Dichroic Mirror; Angle of Incidence 0°

HR	632	HT	1064	/AR	PP0737C
High Reflective coating	Reflected wavelength in nm	High Transmittive	Transmitted wavelength(s) in nm	AR coating on the rear side for the transmitted wavelength (if desired)	Substrate

Dichroic Mirror; Angle of Incidence 45°

HR	1064	HT	400–700	/45	/BBAR	PW1025C
High Reflective coating	Reflected wavelength in nm	High Transmittive	Transmitted wavelength range in nm	Angle of incidence (AOI) in degree	BBAR coating on the rear side for the transmitted wavelengths (if desired)	Substrate

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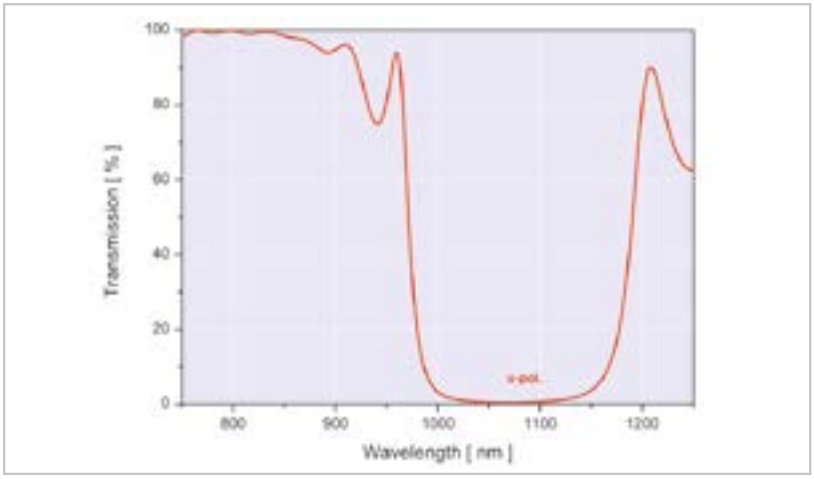
Short-pass Mirrors

HR1064HT808

Degree of reflection	1064 nm	R > 99.7 %
Transmission	808 nm	T > 97.0 %
Back reflection	with AR coating for the transmitted wavelength R < 0.2 %	
Typ. damage threshold	1064 nm 808 nm 532 – 1064 nm	LDT ≈ 30 J/cm² (10 ns) LDT ≈ 5 J/cm² (10 ns) LDT ≈ 1 MW/cm² (cw)
Typ. substrate material	BK7	



HR 1064 nm HT 808 nm / 0°

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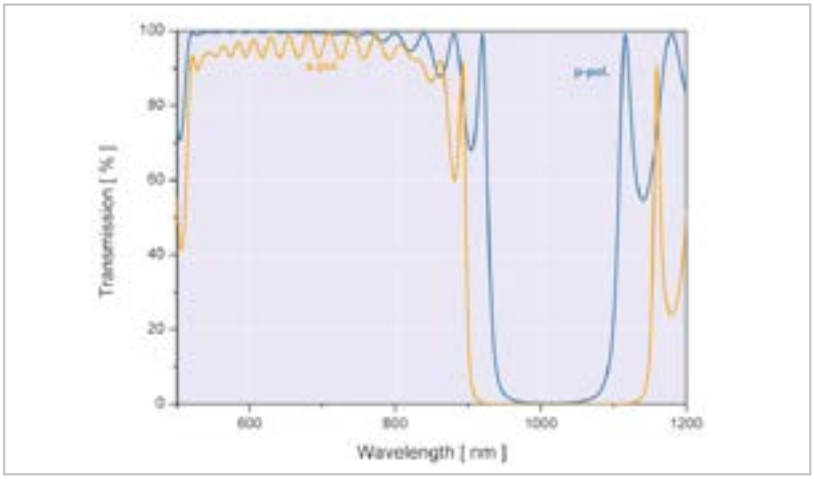
HR1064HT532/45°

Degree of reflection	1064 nm	R > 99.9 % s-pol, R > 99.5 % p-pol, R > 99.7 % u-pol
Transmission	532 nm	T > 93.0 % s-pol T > 97.0 % p-pol T > 95.0 % u-pol
Back reflection	With AR coating for the transmitted wavelength. Specifications upon request (optimized values for u-pol, s-pol or p-pol).	
Typ. damage threshold	1064 nm 532 nm 532–1064 nm	LDT ≈ 30 J/cm² (10 ns) LDT ≈ 10 J/cm² (10 ns) LDT ≈ 1 MW/cm² (cw
Typ. substrate material	BK7	



HR 1064 nm HT 532 nm / 45°

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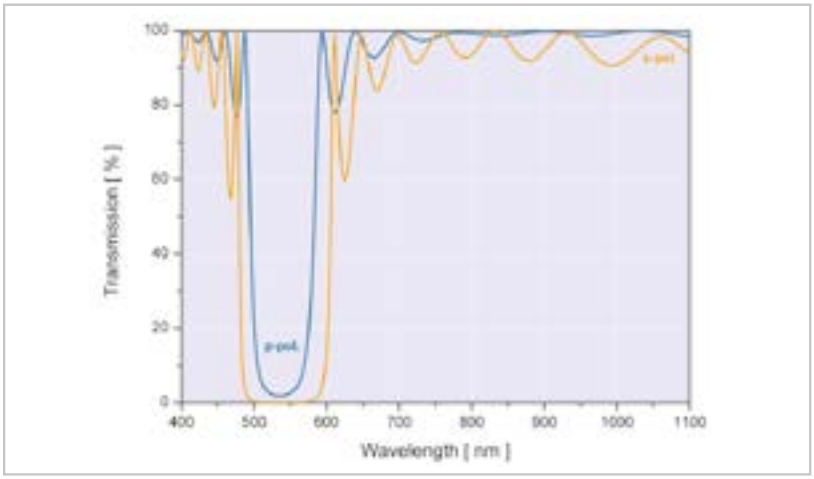
Long-pass Mirrors

HR532HT1064/45°

Degree of reflection	532 nm	R > 99.9 % s-pol, R > 99.5 % p-pol, R > 99.7 % u-pol
Transmission	1064 nm	T > 93.0 % s-pol, T > 97.0 % p-pol, T > 95.0 % u-pol
Back reflection	With AR coating for the transmitted wavelength. Specifications upon request (optimized values for u-pol, s-pol or p-pol).	
Typ. damage threshold	532 nm 1064 nm 532 + 1064 nm	LDT ≈ 10 J/cm² (10 ns) LDT ≈ 10 J/cm² (10 ns) LDT ≈ 1 MW/cm² (cw)
Typ. substrate material	BK7	



HR 532 nm HT 1064 nm / 45°

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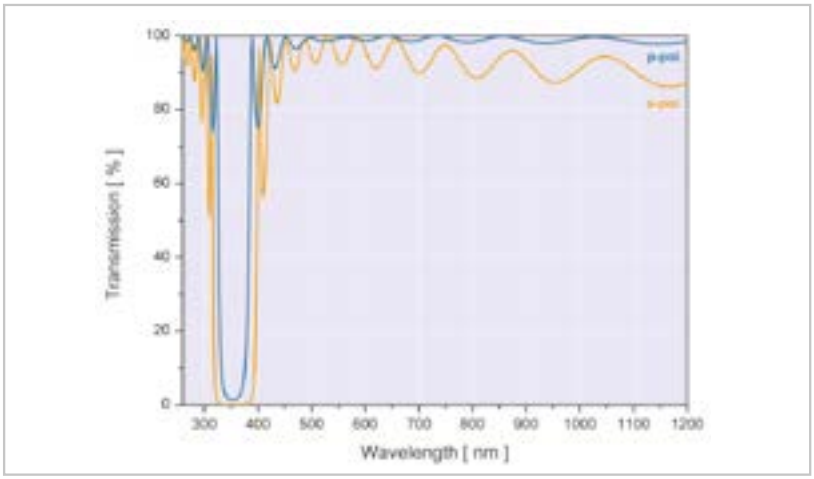
HR355HT532+1064/45°

Degree of reflection	355 nm	R > 99.7 % s-pol, R > 99.0 % p-pol, R > 99.4 % u-pol
Transmission	1064 nm + 532 nm	T > 90.0 % s-pol, T > 95.0 % p-pol, T > 92.5 % u-pol
Back reflection	With D-AR coating for the transmitted wavelengths. Specifications upon request (optimized values for u-pol, s-pol or p-pol).	
Typ. damage threshold	355 nm 532 nm 1064 nm 355–1064 nm	LDT ≈ 5 J/cm² (10 ns) LDT ≈ 5 J/cm² (10 ns) LDT ≈ 10 J/cm² (10 ns) LDT ≈ 1 MW/cm² (cw)
Typ. substrate material	UV-grade fused silica	



HR 355 nm HT 532 nm + 1064 nm / 45°

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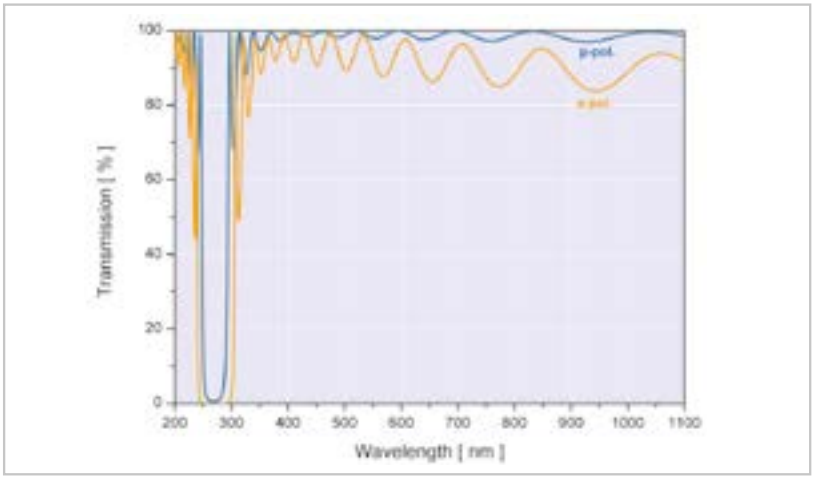
HR266HT532+1064/45°

Degree of reflection	266 nm	R > 99.6 % s-pol R > 97.0 % p-pol R > 98.3 % u-pol
Transmission	1064 nm + 532 nm	T > 90.0 % s-pol, T > 95.0 % p-pol T > 92.5 % u-pol
Back reflection	With D-AR coating for the transmitted wavelengths. Specifications upon request (optimized values for u-pol, s-pol or p-pol).	
Typ. damage threshold	266 nm 532 nm 1064 nm 266 - 1064 nm	LDT ≈ 4 J/cm² (10 ns) LDT ≈ 5 J/cm² (10 ns) LDT ≈ 10 J/cm² (10 ns) LDT ≈ 1 MW/cm² (cw)
Typ. substrate material	UV-grade fused silica	



HR 266 nm HT 532 nm + 1064 nm / 45°

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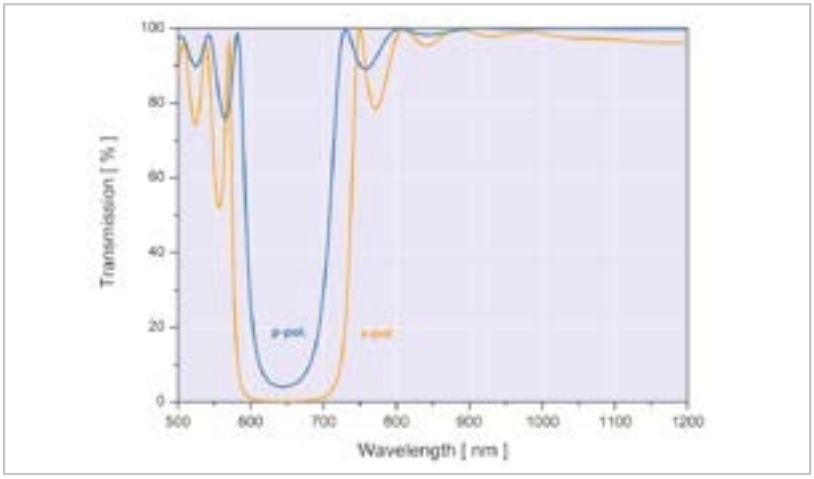
R633>80HT1064/45°

When using pilot lasers, beam combinations of the laser beam and the pilot laser are common.
To guide the pilot beam, bending mirrors with transmitting characteristics for the main laser beam are often used.

Degree of reflection	R > 80 % für 633 nm Higher reflectivities can be manufactured if requested.	
Transmission	1064 nm	T > 93.0 % s-pol, T > 97.0 % p-pol, T > 95.0 % u-pol
Back reflection	With AR coating for the transmitted wavelength. Specifications upon request (optimized values for u-pol, s-pol or p-pol).	
Typ. damage threshold	1064 nm	LDT ≈ 10 J/cm² (10 ns), LDT ≈ 1 MW/cm² (cw)
Typ. substrate material	BK7	



R 633 nm > 80 % HT 1064 nm / 45°

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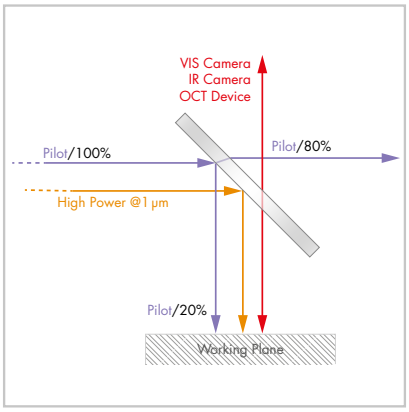
Special Dichroic Mirrors

LASER COMPONENTS manufactures also customized dichroic mirrors that are suitable for your individual application. Especially for monitoring applications there is a variety of functions in a dichroic mirror.
Please find an example in the following text.

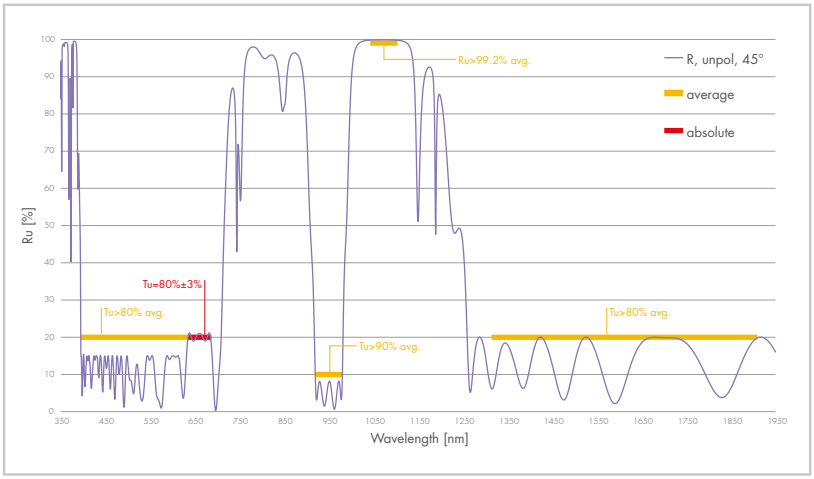
Example 1:

Dichroic with additional functionality

A constant monitoring is an important feature for process control in industry 4.0. This is accomplished by using cameras in the visible and NIR wavelength range. In order to allow the separation and / or combination of the signals for process control together with the process laser customized dichroic mirrors are needed.



This is a typical monitoring application. The optics is needed for bending of the laser which is used for the material processing. At the same time a part of the pilot laser for positioning needs to be reflected for positioning of the workpiece in the working area. Additionally for process control purposes the optics has to transmit the visible range and light in the NIR above the laser wavelength. As an additional feature also special measuring systems like OCT (Optical Coherence Tomography) for depth measurement at a wavelength close to the high-power laser wavelength will be transmitted.



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