

## Partially Reflecting CO<sub>2</sub> Optics

### Features / Characteristics

**Output couplers** and **beam splitters** have a special coating to reflect a defined percentage of the incident light and transmit the remaining part. The reverse side is generally AR coated at 10.6  $\mu\text{m}$ .

**Beam combiner** are used to split or combine light with a different wavelength. Normally they are used at 45° angle of incidence.

### Applications

Output Couplers/Partial Reflector, beamsplitters and beam combiners are used in any type of laser application like e.g. for imaging, medical, and defence.

Partial reflectors are commonly used as laser output couplers or beam attenuators.

Beam splitter are used to split the energy of one laser into two beams. Normally they are not polarization independent, but polarization-independent beam splitters are also available.

Beam combiners are used for external beam guidance e.g. to combine a visible (alignment) with a CO<sub>2</sub> laser. The angle of incidence for standard beam splitters is typically 45° however, other angles are also possible on request.

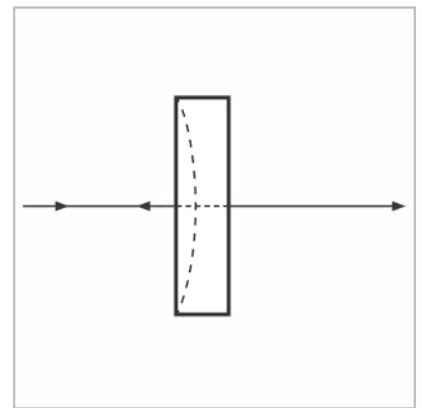


Fig. 1: Output Couplers/Partial Reflectors

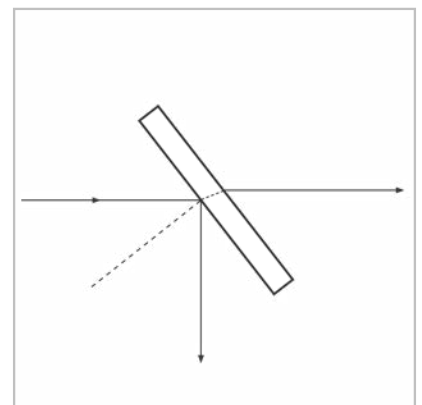


Fig. 2: Beam Splitters

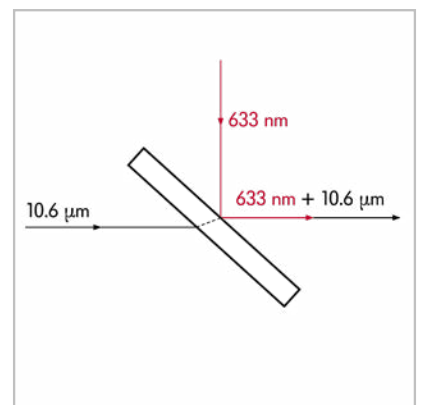


Fig. 3: Beam Combiners

## Specifications

Diameter tolerance	+0/-0.2 mm
Thickness tolerance	±0.25 mm
Wedge	<3 arc min.
Surface figure	typ. $\lambda/20$ at 10.6 $\mu\text{m}$ (depends on diameter thickness ratio)
Surface quality	40 – 20
Clear aperture	>85% of diameter
Laser damage threshold of coated component	depends on the beam diameter, typ. 3000 W/mm (CW CO <sub>2</sub> Laser) (3 kW per mm of beam dia. $1/e^2$ )

## Simulations for Beam Combiner

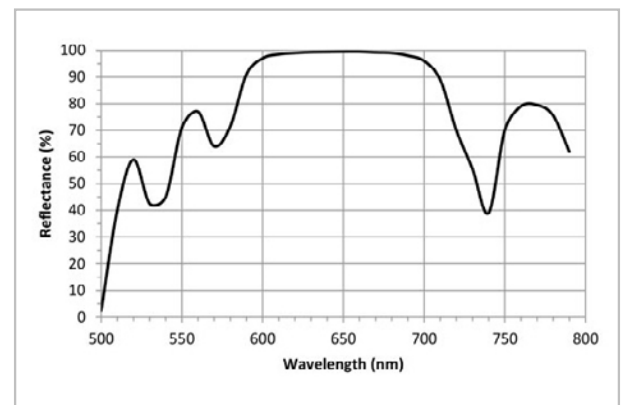
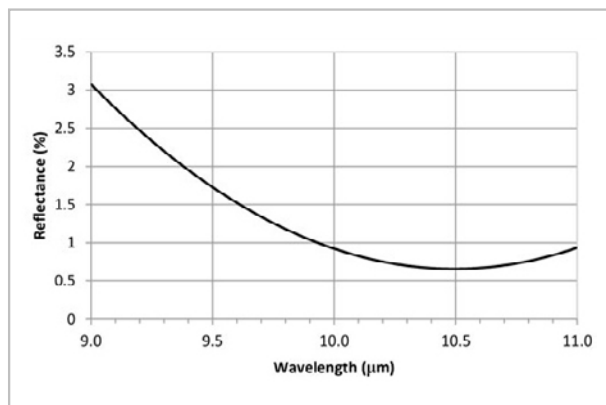


Fig 4: Typical reflectance trace for a standard beam combiner

Simulation for beam splitter and output coupler upon request.

## Good to know

### 1. Partially Reflectors/ Output Couplers

- Output couplers are available in both planar and curved form.
- Typ. reflectivities are for example: 17%, 50%, 65%, 75%, 80%, 98%.
- If the tolerances are important for you please advise which value is needed.

## 2. Beamcombiner

Beamcombiner are used at an angle of 45° to add pilot beams to the beam path. They offer a maximum reflection for typical wavelengths in the visible range (e.g. 633 nm) and simultaneously a maximum transmission at 10.6 μm.

### 2.1. Reverse' Beam combiners

Coatings providing the opposite effect, i.e. maximum T (short λ) and maximum R (long λ), are not available. 'Reverse' beam combiner assemblies consisting of a standard beam combiner and three mirrors are available however.

## 3. Beam Splitter

Beam splitters are typically used at an angle of 45° and optimized for each polarization. A variety of reflectivities is available, obviously 50% is common. For other values please send us your request.

### 3.1. Polarization-insensitive beam splitters

Standard 50:50 beam splitters effect the polarization of both the reflected and transmitted beams. We can offer a special coating 'recipe' which eliminates this problem, allowing components to be used to provide a 50:50 power split at 45° incidence angle, reflecting 50% of both 'S' and 'P' polarization. As a result, incident circularly – polarized radiation is split equally into two circularly polarized beams.

Due to the relatively high level of absorption in the coating, incident intensity levels should not exceed 500 W/cm<sup>2</sup> in order to avoid thermal-lensing effects.

- Specification: reflectivity: 50% ± 1%
- [Both R(s) and R(p)] absorption: <1.5% at 10.6 μm, 45° incidence
- Laser damage threshold : > 200 W/mm cw

### 4. For inquiries, we need to know:

- Diameter
- Thickness
- Flat or radius of curvature
- Wavelength
- AOI
- Reflectivity
- Polarization is needed for the beam splitter

Customer designs are available upon request.

## 5. Handling

Safety data sheet and handling inspections are available upon request (in German only).

## Product Code

## Output Couplers



For example:

PZ-1011-20-600: diameter 25.4 mm, thickness 3.0 mm, radius (concave) = 20 m, reflectivity 60%

## Beam Splitter



For example:

BSZ-1011-S50 ZnSe-beamsplitter, Ø 1" x 3 mm, Rs = 50%, 10.6 µm, 45°

## Beam Combiner



For example:

BCZ-1011-633/45 ZnSe-beam combiner Ø 1.0" x 3 mm, Rmax 633, Tmax 10.6