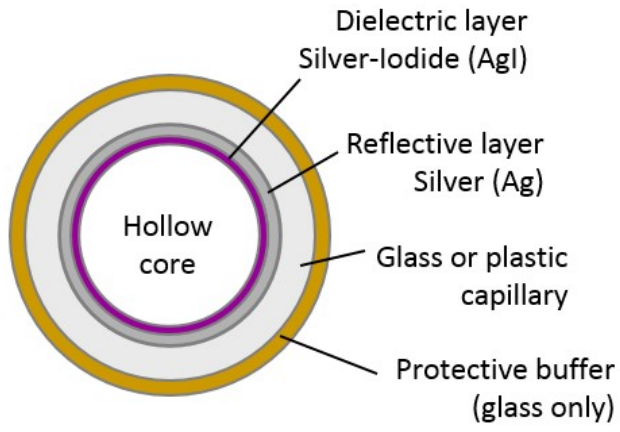
Mid-Infrared (Mid-IR) Fiber Optic Solutions

Hollow core fiber cables are fully customizable including length, coating and termination. Email us with your request or use our Custom Request Form.

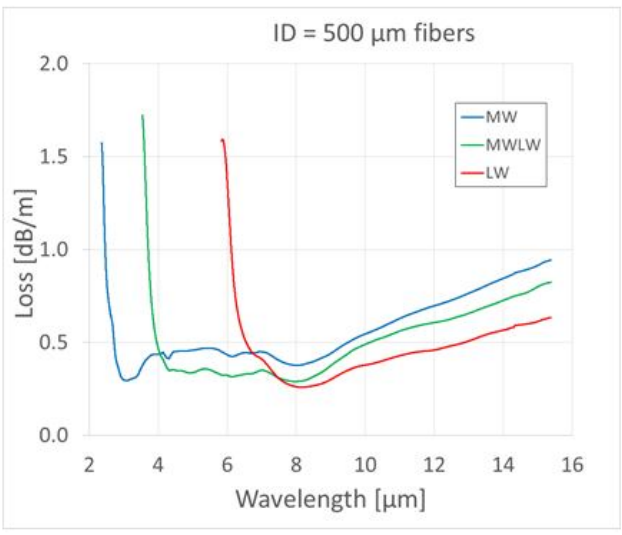
Package hollow core fibers with SMA connectors



Mid-IR Hollow Fibers

Hollow core fiber optics (i.e., waveguides) are the ideal solution for many Mid-IR applications requiring remote laser beam delivery. Benefits include the following:

- Good transmission from: λ = 2 – 16 µm
- Single mode options for λ ≥ 5 µm
- Mode filtering of non-Gaussian beams
- High coupling efficiency (> 95%)
- High energy/power (up to 100 W CW)
- No end reflections
- No cladding modes
- Robust and Flexible

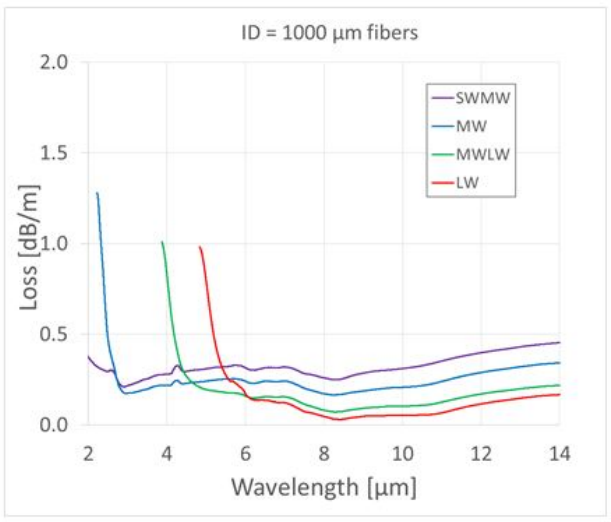


Internal Dielectric Coating

The relative spectral transmission of hollow fibers depends on the thickness of the dielectric layer deposited inside the hollow fiber. This thickness is a parameter that we have full control over and can be tuned for a specific wavelength range with thicker coatings giving better transmission for longer wavelengths. We offer 4 standard coating options covering the entire Mid-IR. Alternative structures are available for other wavelength regions including UV, Visible/NIR, and THz.

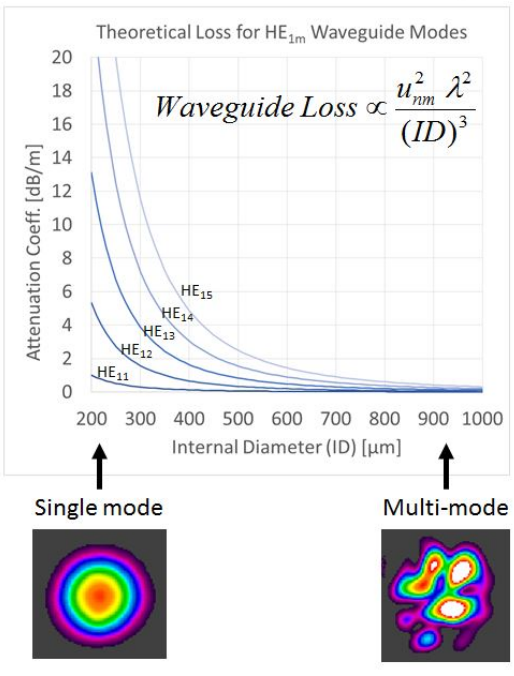
	Glass					Plastic
Internal Diameter (ID)	200 µm	300 µm	500 µm	750 µm	1000 µm	1500 µm
Typical Loss (straight)†	4 dB/m	1 dB/m	0.5 dB/m	0.2 dB/m	0.1 dB/m	0.2 dB/m
Single Mode Range	λ ≥ 4 µm	λ ≥ 8 µm	λ ≥ 12 µm	---	---	-
Output Divergence ½ Angle‡	50 mRad	40 mRad	30 mRad	30 mRad	30 mRad	30 mRad
Minimum Bend Radius	5 cm	5 cm	10 cm	20 cm	50 cm	10 cm
Maximum Power*	5 W	10 W	30 W	50 W	100 W	30 W
Patch Cable Length	0.1 - 1.0 m	0.1 - 2.0 m	0.1 - 5.0 m	0.1 - 5.0 m	0.1 - 5.0 m	0.1 - 5.0 m

† Additional loss on bending, which scales with bending radius (R) as 1/R.
‡ Value listed is for λ = 10 µm, and generally scales linearly with wavelength
* CW power rating assuming proper coupling and alignment. Initial alignment should always be done at reduced power.



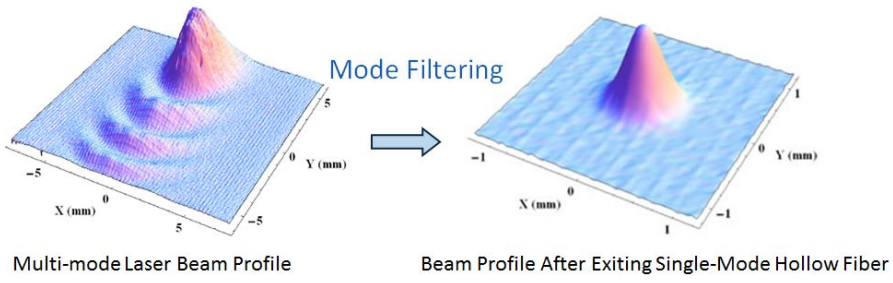
Fiber Internal Diameter (ID)

Overall transmission in hollow fibers depends strongly on the fiber internal diameter (ID). Theoretically, loss can be described by Hybrid HE lm modes. The attenuation coefficients of such modes depend on the internal diameter as 1/(ID)3. In addition, there is a strong dependence on the mode#. Larger ID fibers have lower loss, but support more modes (i.e., multi-mode). Smaller ID fibers have higher loss, but heavily damp out the higher order modes, and can thus deliver single mode output. Furthermore, such single-mode fibers are very effective at filtering out higher order mode, and "cleaning" up non-ideal beams. Guiding Photonics is also in the process of developing tapered hollow fibers, in which the diameter gradually changes along the length of the fiber.



Effective N.A.

The output divergence angle listed in the table above can be thought of as the effective numerical aperture (NA) of the fiber. The term "effective" NA is used since this is not equivalent to the NA for a solid core fiber. A solid core fiber works on the principle of total internal reflection, and for such fibers the NA is a strict cut-off in terms of acceptance angle. In contrast, our hollow core fibers are essentially a reflective light pipe (i.e., waveguide), and here the term, effective NA, can be thought of as an optimal coupling angle, but is not a strict cut-off. The hollow fibers will guide light at a higher NA; however, the further one gets from optimal coupling, the lower the transmission and the further from single-mode performance.



Multi-mode Laser Beam Profile

Beam Profile After Exiting Single-Mode Hollow Fiber