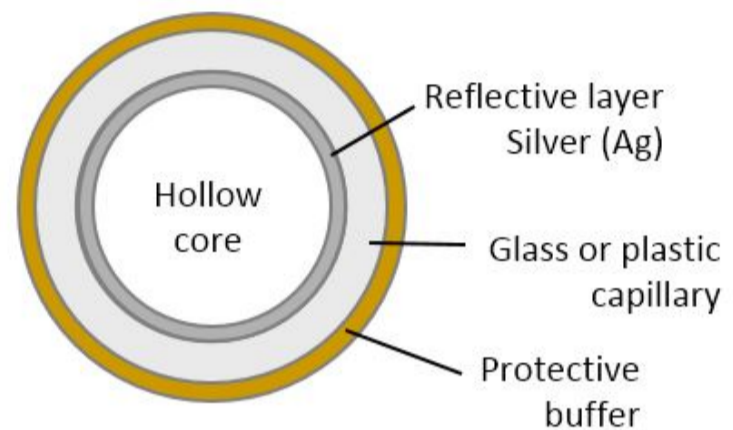


Hollow Fibers Optics Solutions for UV and Visible / NIR



Packaged hollow core fibers with SMA connectors

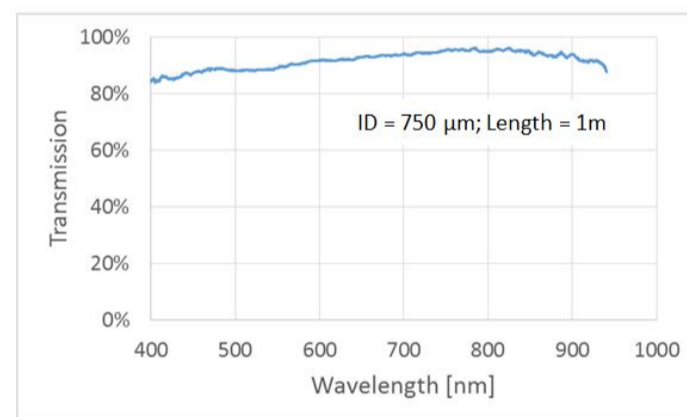


Cross-section of bare hollow core fiber

Hollow fibers with a silver reflective coating enable convenient delivery of high energy pulsed lasers. Coupling efficiency can be near 100% and pulse dispersion is negligible. Such fibers have been used in CARS experiments, delivering 50 mJ / 5 ns pulse laser beams with wavelengths at 532 nm and 607 nm over a 5 m length.

Fiber Internal Diameter (ID)

Overall transmission in hollow fibers depends strongly on the fiber internal diameter (ID). We offer four different standard ID size options ranging from ID = 500 μm to 1500 μm , and all of these fibers are multimode. Bending of the fiber will affect the beam quality and lead to higher loss. For best results, an input beam should be focused straight into the hollow fiber with a relatively long focal length optic such that the focused spot size is about $\frac{1}{2}$ the fiber ID.



Silver Reflective Layer

For the visible to NIR wavelength range ($\lambda = 400 - 1600 \text{ nm}$), a bare silver layer is deposited on the inside of glass capillary tubing. The surface quality of the silver layer is vitally important, and Guiding has developed coating techniques to minimize surface roughness enabling relatively high transmission.

| Internal Diameter (ID) | 500 μm | 750 μm | 1000 μm |
|--|-------------------|-------------------|--------------------|
| Typical Loss (straight) | 1.0 dB/m | 0.4 dB/m | 0.3 dB/m |
| Max Energy* ($\lambda = 532 \text{ nm}; 5 \text{ ns}$) | 20 mJ | 50 mJ | 75 mJ |
| Maximum Power * | 30 W | 50 W | 100 W |
| Minimum Bend Radius | 10 cm | 20 cm | 50 cm |
| Patch Cable Length | 0.1 - 5.0 m | | |

Additional loss on bending, which scales with radius (R) as $1/R$.
Assuming proper coupling. Initial alignment should always be done at reduced power.

Coupling

Coupling into silver-only hollow fibers is similar to coupling into our Mid-IR fibers. In general, a relatively long focal length lens should be used with the beam focused straight into the fiber.

Related Publication:

A. Alexander, P. Hsu, J. A. Wehrmeyer, S. Roy, J. R. Gord, and J. M. Kriesel " Gas-Phase Temperature Measurements at the Exhaust of a J85 Engine using Coherent Anti-Stokes Raman Scattering ", 53rd AIAA Aerospace Sciences Meeting, January 2015

Kriesel, Jason M., Gat, Nahum, and Plemmons, David, "Fiber Optics for Remote Delivery of High Power Pulsed Laser Beams," Proceedings of the 48th AIAA Aerospace Sciences Meeting, Orlando, FL, January 2010.