Opto Knowledge

20 YEARS
1991 - 2011

Converting Light into Knowledge

Mid-IR Fiber Optics
Hollow Glass Waveguides

a. Fiber delivery of QCL

b. Output Beam Profile

Waveguides with reflective layer and thin-film dielectric coating applied using novel processes
Dielectric coatings can be optimized for specific wavelengths or for broadband applications

Configurations

Single-Mode - high beam quality for $\lambda \geq 8$ µm

Multi-Mode - low loss for $\lambda \geq 3$ µm

Bundles for remote IR imaging / signal-collection

Key Features

Excellent transmission across Mid-IR spectrum (3 µm $\leq \lambda \leq$ 16 µm)

Gaussian beam delivery

Simple, high efficiency coupling

Mode filtering

High damage threshold

Robust and flexible

No end reflections - reduced laser feedback

No cladding modes - reduced system noise

Opto Knowledge
Recipient of the 2011 Tibbetts Award

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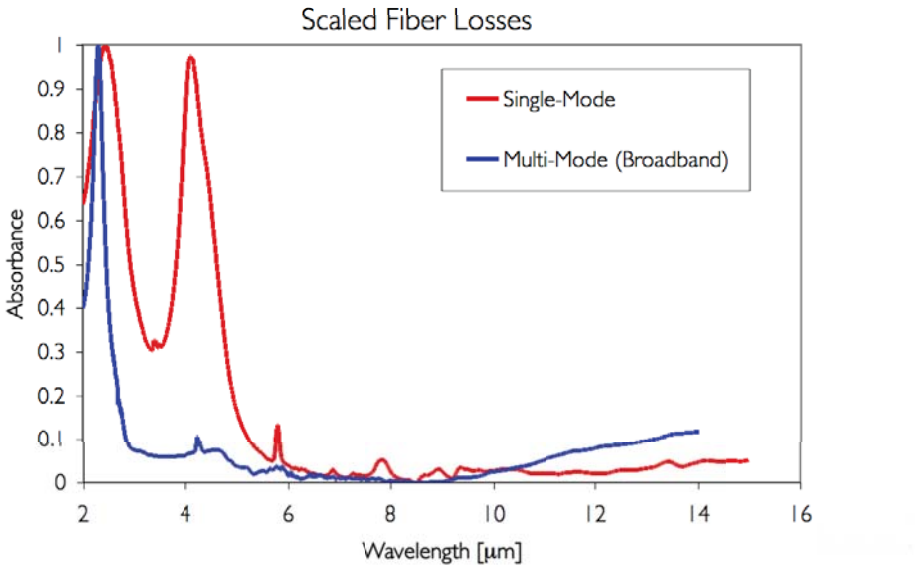
Mid-IR Fiber Optics

Mid-IR Fiber Optics Characteristics

Property	Single-Mode	Multi-Mode	Comments
Bore Diameter	300 µm	700 µm	Other sizes available upon request
Staight Loss / Length	1 dB/m	0.1 dB/m	Measured at λ = 10.6 µm
Typical Bending Loss	0.3 dB	0.3 dB	Measured for 90 deg bend with radius = 0.25 m
Spectral Range	6 to 16 µm	3 to 16 µm	Can be optimized for different ranges
Numerical Aperture	0.035	0.015	Value at λ = 9 µm
Coupling Efficiency	> 90 %	> 90 %	Using NA-matched optics
Power Rating	30 W	100 W	Higher power possible with cooling



Shown with collimating optics

Applications

Laser delivery

Spectroscopy

IR imaging

IR countermeasures

Small volume gas cell

Custom Optics for

Beam coupling

Beam collimation

Beam focusing

Signal collection

IR imaging (fiber bundles)

In Development

Single-mode fibers for λ = 3 to 5 µm

Lower loss fibers using next generation coating techniques

Tapered fibers for various applications

Fibers for high energy, visible wavelength beam delivery

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