IRflex

www.irflex.com

HC-ARA Fiber (Patented)

Hollow-Core Fiber with Anti-Resonant Arches

IRflex' innovative hollow-core fiber with anti-resonant arches (HC-ARA) is designed and made of chalcogenide glass As_2S_3. The HC-ARA fiber has a single layer of eight non-touching curved arches, each one being solidly attached at two locations on the outer solid region to prevent any lateral displacement and to preserve the arches' shape and uniformity during the fabrication process. The thickness and spacing between the arches are selected respectively to minimize the fiber transmission loss <0.1 dB/m for CO_2 laser between 9 to 11 micron, CO laser around 5 micron or Er:YAG laser around 3 micron. Also, the higher order modes of the HC-ARA fiber are more attenuated than the fundamental mode, so the fiber is effectively single mode after only a few meters. The HC-ARA preform is made by extrusion of chalcogenide glass through a die specifically designed to produce the anti-resonant arches. The extruded HC-ARA preform is pulled in a fiber using photonic crystal fiber draw techniques.

Applications

- High-power/energy laser transmission
  - CO_2 laser: 9 to 11µm
  - CO laser: 5µm
  - Er:YAG laser: 3µm
- Medical Lasers
  - Dentistry
  - Cosmetic Surgery
  - Therapeutic
- Gas spectroscopy
- Sensors

Key Features

- High power/energy laser transmission: >50W CW
- >99% of the optical power/energy is confined in the hollow core
- Low loss <0.1dB/m
- Good beam quality M^2~1
- Optimized design options for wavelength around 3µm, 5µm and 8.7 to 11.55µm
- Can be gas filled
- Low bend loss

IRflex Corporation is the only U.S. company totally dedicated to the development and manufacture of mid-infrared fibers and devices for wavelengths from 1.5 to 11 micron.

IRflex has several patents on specialty chalcogenide optical fibers and expertise in these fibers' design and development. These strong patent portfolios and intellectual know-how, coupled with advanced manufacturing processes, are the core competencies which enable IRflex to sustain its leadership in the mid-infrared industry and provide cutting-edge products for mid-infrared applications.

Preliminary Technical Specifications

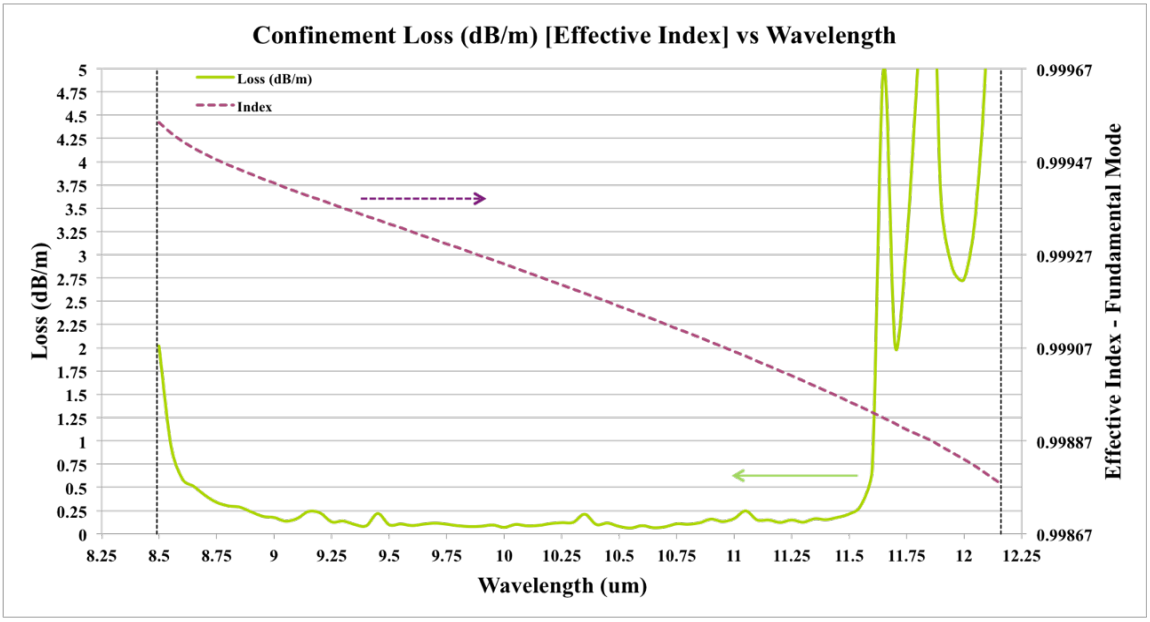
Transmission Window (μm)[1]	8.70 – 11.55
Bend Radius	15 cm
Effective Core Diameter	185 μm
Cladding Diameter	610 μm

Fundamental Mode Characteristics

Design Wavelength (λ_D)	10.6 μm
Fundamental Mode Loss @ λ_D	0.08 dB/m
Effective Fundamental Mode Index @ λ_D	0.99914
Numerical Aperture[2] @ λ_D	0.067
Fill Factor[3] @ λ_D	99.58%
Mode Field Diameter[4] @ λ_D	141 μm
Mode Loss at a bend radius of 15cm @ λ_D	< 0.20 dB/m

1) Specified for wavelengths with fundamental mode loss ≤ 0.5 dB/m.
2) Taken as the sine of the angle at which the intensity falls to 5% of its maximum value in the far field.
3) Fraction of mode power flux contained in a radius of 92.5 μm from the center of the hollow core. (This region is essentially air)
4) FW1/e^2 of the intensity distribution.

Fiber transmission optimized for wavelength from 8.7 to 11.55μm



Calculated loss spectrum for chalcogenide HC-ARA fiber with 8 anti-resonant arches of thickness 3.9 micron, 185-micron core diameter and 21.45-micron gap.

Disclaimer: The specifications and graphs presented in this sheet are preliminary results of numerical calculations ran with commercially available software using the Finite Element Method and a triangular adaptive mesh with PML.

IRflex
300 Ringgold Industrial Parkway
Danville, Virginia, 24540, USA
1 434 483 4304
www.irflex.com
MADE IN USA