"The Mid-IR Fibers and Devices Company"

Chalcogenide MWIR Fused Fiber Combiner (1.5 to 6.5µm)

www.irflex.com

Beam combining devices are extensively used to achieve power levels that cannot be reached by the use of just a single laser. To achieve beam combination these devices commonly employ free-space optics like mirrors, gratings and lenses, which has issues such as thermal sensitive, vibration induced misalignment, complex packaging and bulky design. Fiber beam combining can provide the high power levels with the additional benefit of being compact and robust; permitting simple packaging and meeting stringent environmental requirements. Fiber optic combiners take multiple fibers and fuse them together to form a monolithic common output aperture, thereby combining their output powers and wavelengths.

Silica fiber power combiners are used to combine power for pumping double-clad fiber lasers and incoherent beam combining of high power lasers, but are limited to the near IR. Inspired by these silica combiners, IRflex's proprietary manufacturing technology of chalcogenide glass Mid-IR fibers make it possible to extend the power combining capacity beyond the 2µm silica fiber wavelength range.

Chalcogenide glass fibers are the ideal candidates to manufacture the mid-wave infrared fiber combiner. Chalcogenide glass is based on the chalcogen elements (sulfur, selenium, and tellurium) with the addition of other elements such as arsenic, antimony, or germanium. It offers promising properties such as transmission in mid and far infrared regions of the spectra, lower values of phonon energies, high refractive index, and very large nonlinearities as compared to silica.

Chalcogenide fiber offers a good building block for such device with low-loss transmission (0.1dB/m) in the MWIR (1.5-6.5um) and excellent power handling.

Using IRflex's arsenic sulfide glass fibers, IRflex's multimode Mid-IR fused fiber combiners can incoherently combine the power from multiple laser sources into a common output aperture. These combiners can also spectrally combine laser sources that cover the MWIR spectrum.

APPLICATIONS:

- Power and wavelength combining of IR diodes and quantum cascade lasers for high power laser systems.
- Remote sensing
- Long-range target identification and LIDAR
- Gaseous leaking detection, mineral and petroleum prospecting
- Medical surgery

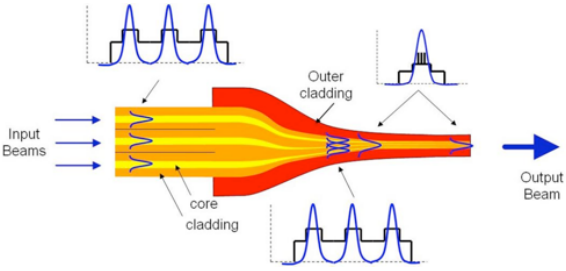
KEY FEATURES:

- High port transmission and combining efficiency for MWIR spectral beam combining up to 95%
- Independent wavelength transmission from 1.5 to 6.5µm
- High power handling strength with mechanical flexibility
- Custom configurations availability

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

IRflex has several patents on specialty optical fibers and expertise in specialty optical fiber design and development. A suite of patents relating to chalcogenide glass based fiber optics has been licensed to IRflex from the U.S. Naval Research Laboratory (NRL). These strong patent portfolio 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.

Fused Fiber Combiner Concept



Technical Specifications

Models	Ports	Operation Wavelength	Input Fiber	Output Aperture	Port Transmission Efficiency
MWIR-FC-3	3-to-1	1.5 to 6.5µm	100µm core diameter NA=0.30	100µm diameter NA=0.30	75 to 95%*
MWIR-FC-7	7-to-1	1.5 to 6.5µm	50µm core diameter NA=0.20	100µm diameter NA=0.20	75 to 95%*

** Customers outside of the United States, please note our current export permit limits the combined input power under 5 Watts(CW).*

The input fiber connector types include FC/APC, FC/UPC, SMA or IRflex's FC/B® - the FC connector at Brewster Angle that enables perfect coupling without reflection with polarized laser beam. The standard output fiber connector is SMA connector.

Due to chalcogenide glass' high refractive index (n=2.4), approximately 17% of the light will be reflected at each interface, which results in a total transmission of 69% of the incident light. To meet optimum transmission requirements, the fiber end faces may need to have anti-reflection (AR) coatings to increase the throughput of the system and reduce hazards caused by reflections traveling backwards through the system (ghost images). AR coating is also very durable, with resistance to both physical and environmental damage.

IRflex offers Anti-reflection coating, broadband or at a specific wavelength, to any flat input and output fiber connector of the MWIR Fused Fiber Combiner as an option.

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Made in America