



ATR fiber probes coupling for Mid-IR applications

ATR fiber probes are used for real-time in-situ analysis and reaction monitoring. These probes can be utilized not only with FTIR and NDIR spectrometers but also with other infrared devices, light sources, and detectors, for example, with Dual-Comb Spectrometers.

Most common light sources in FTIR spectrometers are broadband lamps – Globars-- with a spectral behavior similar to a Planck radiator (i.e., a black body). However, these traditional sources have quite low spectral brightness, which is several orders of magnitude lower than that of supercontinuum light sources that are also spectrally broadband*. Quantum cascade lasers (QCLs) or interband cascade lasers (ICLs) offer the highest spectral brightness and output power; however, they typically have a narrow linewidth. Infrared LEDs can also serve as a cost-effective alternative to QCLs/ICLs at shorter wavelengths.

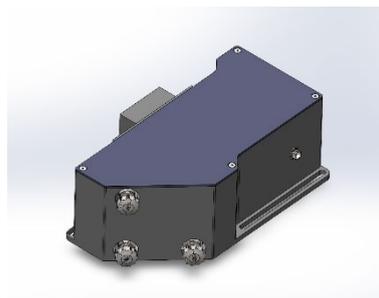
For high-sensitivity applications, an ATR fiber probe can be coupled with various detectors, such as InAsSb, PbSe or MCT (HgCdTe) detectors. These detectors can be thermoelectrically cooled (TE-cooled) or cooled with liquid nitrogen (LN-cooled).

Powerful light sources and sensitive detectors coupled with ATR probes can significantly improve the signal-to-noise ratio and increase spectral acquisition speed. This combination also enables the use of much longer fibers while still maintaining an acceptable SNR.

* Zorin, I., Gattinger, P., Ebner, A., & Brandstetter, M. (2022). Advances in mid-infrared spectroscopy enabled by supercontinuum laser sources. *Optics Express*, 30(4), 5222

Couplers for IR detectors

To connect an ATR probe to a stand-alone detector, the output light from one of the probe's legs must be directed into the detector via a fiber coupler. Like those for light sources, these couplers are not limited to ATR probes; they can also be used with stand-alone infrared fibers.



Optical fiber coupler from art photonics for TE cooled IR detector UHSM-I-10.6 from VIGO.



Optical fiber coupler from art photonics for LN Cooled MCT Detector from InfraRed Associates.

Coupling probes with IR light sources

To couple light from an infrared light source into an ATR probe, the beam must be focused into one of the probe legs fiber. Dedicated optical fiber couplers are available for certain quantum cascade lasers (QCLs), such as the MIRCAt and Hedgehog QCLs from DRS Daylight Solutions. These couplers are universal and can be used not only with ATR probes but also with stand-alone infrared fibers. Adapters are SMA and FC/PC.



Optical fiber coupler from art photonics for QCL laser MIRCAt from DRS Daylight Solutions.

Spectral ranges of Infrared ATR probes

The performance of an ATR probe, when paired with a specific light source or detector, is determined by a working spectral range of ATR probes with a selected ATR crystal. Typical transmission spectra of ATR probes are shown on the figure.

Typical transmission of infrared ATR probes 1.5m long with specified ATR crystals.

