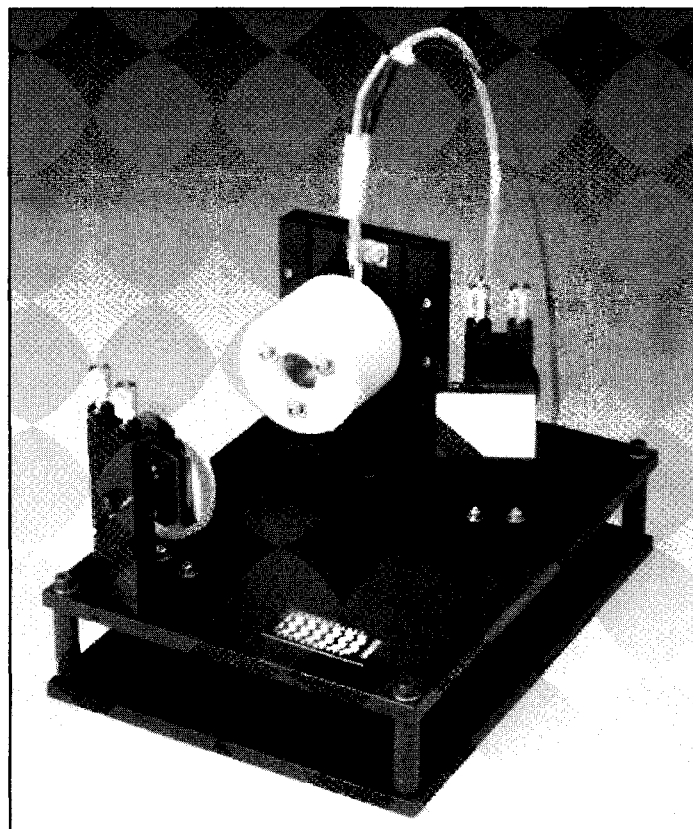


# The Insider™

## FT-IR Emission Accessory



### Applications

- Determine laser diode spectral emissions
- Characterize semiconductors
- Detect coatings on opaque substrates
- Study spectral emissivity of solids
- Measure transition temperatures of thermochromatic materials

### Ordering Information

- 09B100 Insider Emission Accessory, including transfer optics, heated cell, thermocouple, heaters
- 25B600W Single Channel Temperature Controller

## *CIC Photonics, Inc.*

### Features

Designed by Founder<sup>1</sup> of CIC Photonics to fit "inside" your FT-IR sample compartment.

- Makes use of the second (normally unused) beam of the Michelson interferometer, without modification to the spectrometer
- Unique field splitting mirror directs the sample emission image into the interferometer
- The returning modulated beam completely misses the splitter mirror and travels to the detector
- Standard sample slide mount is positioned at the field stop of the spectrometer
- Usable to 400°C with MCT detector & to 100°C with DTGS detector

### *CIC Photonics, Inc.*

~~3825 Osuna Rd NE, Suite 6~~  
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Corporate Headquarters: **505/343-9500**

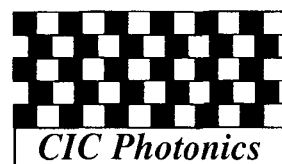
~~Sales: 800/635-3051~~

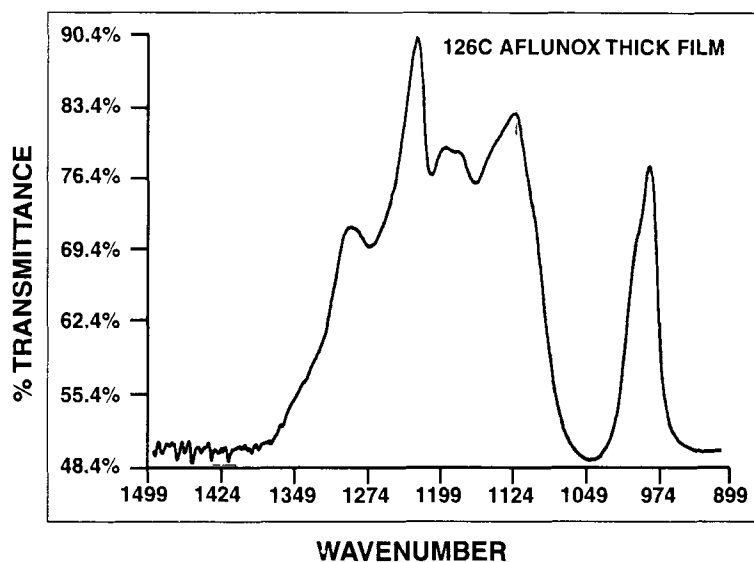
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*Finding the Path to Optimum Results*





## Theoretical Solution

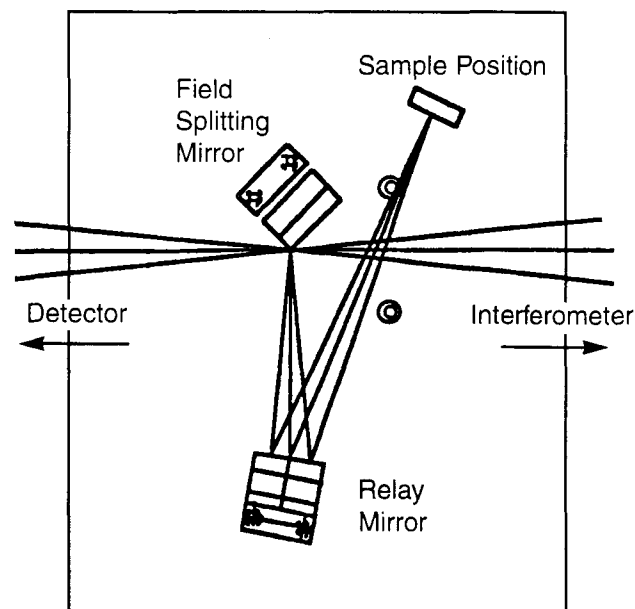
When the temperature of any sample is raised, the Boltzmann population of the vibrational energy states is also raised. Upon return to ground state, radiation is emitted. In theory, emission spectra can be measured any time a sample is at a different temperature than the detector.

Although no new chemical information can be obtained by using emission spectroscopy rather than absorption or reflection spectroscopy, the emission technique can sometimes provide a more convenient method of acquiring the same data. The reason? No source other than the heated sample is required and reactions at high temperature can be studied directly. Emission spectra are often referenced to the energy emitted by a black body at the same temperature as the sample being studied: hence, spectral emissivity curves are generated over specified wavelength regions. The emission technique has potential for quantitative analysis of films as thin as 100 Å.

By contrast, spectroscopic analysis of solid surfaces by reflection techniques is sometimes difficult as a result of sample holder limitations and the contribution from the specular component of the reflection superimposed on the reflection spectrum.

## Sample Characteristics

The emissivity of a solid surface can vary greatly depending on the degree of surface roughness, oxidation, and absorbed layers. In addition to the emissivity of a sample, measurement temperature and detector sensitivity must be taken into account. The ideal sample for emission studies is a very thin surface layer supported on a perfect reflector. Bands which appear sharp in thin films become broader as the film thickness increases as a result of energy reabsorption.



*With the Insider in the sample compartment, the beam emitted from the sample is imaged onto the field splitting mirror where it is directed into the interferometer. Result: the returning modulated beam completely misses the splitter mirror and travels to the detector.*

## Design

The Insider takes advantage of the fact that in a Michelson interferometer, two modulated beams are created. In a normal sampling mode, one beam travels back to the source and is lost. The other beam travels out of the interferometer into the sample compartment and on to the detector. These two beams are equivalent, except that they are out of phase. The Insider makes use of the second (normally unused) beam of the Michelson interferometer to allow emission measurements to be made in the sample compartments - without modifying the instrument at all.<sup>1</sup> This method, first proposed by Ford and Spragg,<sup>2</sup> is 50% efficient relative to using an emission port.

## Operation

The Insider includes a standard sample slide mount and a heated cell. The heated cell is placed in this sample mount. Heat input is provided by three cartridge heaters mounted in the cell walls. The cell is heatable to 400°C and can be maintained at plus or minus 1°C. It accommodates a variety of sample geometries. The temperature is monitored with a type K thermocouple and an optional digital controller. The spectrometer source should be turned off or blocked. The uncomplicated optical design makes alignment easy.

### References:

1. R.T. Rewick and R.G. Messerschmidt, *Appl. Spec.* 45, No 2, February 1991.
2. M.A. Ford and R.A. Spragg, *Appl. Spec.* 40, 715-6, 1986
3. S.V. Compton, D.A.C. Compton, and R.G. Messerschmidt, *Spectroscopy*, July/August 1991, pp. 35-38.