V70v

Vacuum FT-IR spectrometer: spectral range from 8,000 to 350 cm^{-1}:
- The spectrometer shall be capable of a working pressure of < 0.2 mbar.
- MIR-KBr beamsplitter (T303/3)
- Room temperature DLaTGS detector (D301/B)
- High power IR source
- Aperture wheel with 12 positions
- Validation wheel with 6 positions
- Vacuum optics bench with oil-free vacuum pump
- OPUS/IR software package
- RockSolid™ cube corner, mirror-based permanently aligned interferometer

See attached sheets (below) for more complete specifications.

Reasons for specifying the 70v

This spectrometer will be used for multiple programs, but its primary function in the immediate future will be for polarization-modulation infrared reflection-absorption spectroscopy (PM-IRRAS) and for attenuated total internal reflection - multiple internal reflection IR spectroscopy (ATR-MIRS). Both of these techniques (but especially PM-IRRAS) impose very stringent constraints on the acceptable signal to noise, temperature stability, and background gas levels. It is for this reason that the 70v is recommended. The 70v is capable of maintaining <0.2 mbar vacuum during operation, which dramatically reduces both the background gas signature and the temperature stability.

The interferometer and sample chambers must be separately evacuable and purgeable so that the sample compartment can be vented without losing vacuum in the interferometer or detector chambers.

The signal to noise is the highest available, due in part to the RockSolid Interferometer available on the 70v. The signal to noise for a 5 second 100% line measurement should exceed 12,000:1 peak-to-peak (or < $4.8*10^{-5}$ AU noise) under the following conditions:

- 4 cm^{-1} spectral resolution
- Blackman Harris 4-Term apodization
- DTGS detector, KBr beam-splitter (7,800–370 cm^{-1}) and air cooled source
- Noise calculated as peak-to-peak between 2200 to 2100 cm^{-1}

PM-IRRAS also requires very high spectral resolution. The instrument spectral resolution should be continuously variable to a maximum of at least 0.4 cm^{-1} (apodized) and should be upgradeable to better than 0.16 cm^{-1} resolution (non-apodized). In the visible spectral range, the resolution power should exceed 300,000:1 ($\nu/\Delta\nu$).

The standard spectral range needs to be very large to accommodate current and future experiments in different programs. It should be a minimum of 8,000-350 cm^{-1}. However, since the instrument will be used for additional programs, it is critical that it have a very wide spectral range upgrade capability, i.e., 28,000 - 10 cm^{-1}.

The spectrometer must have the option for upgrading to two or more internal MIR or NIR sources selectable with software.

Available detectors must include DLaTGS with a KBr, CsI or PE window; MCT-Narrow, Mid and Wide Band types; Photovoltaic MCT and InSb; room temperature InGaAs; and TE cooled InGaAs as well as Si-and GaP-diode detectors, liquid He cooled bolometers and hot-electron InSb detectors for the far IR and Terahertz spectral range.

The system must provide two external detector ports at front and left side of the optics bench for the use of liquid He cooled detectors. The optical bench must support at least five computer controlled external beam output ports to accommodate future instrument expansion to interface the FT-IR with external sample compartments, TGA-IR interfaces, Infrared Microscopes, NIR & MIR Fiber Optic probes, etc. For maximum accessibility the output ports should be located tothe side, front and left of the optics bench. Optical bench must support up to 2 computer controlled input beams accessible from the right and rear side of the spectrometer optics. The right side input beam must pass though both the internal aperture and validation wheels.

We anticipate performing a number of kinetics experiments, so the spectrometer must have a rapid scan kinetics capability of >42 spectra per second at 8 cm^{-1} optical resolution.

The spectrometer must be field upgradable with a step scan option for time resolved spectroscopic measurements (TRS) down to 2 nsec. The effective position accuracy of this method must be < 2-3 nm (this is achievable only due to the ability to evacuate the system and therefore minimize gas-derived temperature fluctuations).