

## **Specifications for a Fourier Transform Infrared Spectrometer and Microscope System**

The Naval Research Laboratory (NRL) has a requirement for a Fourier Transform Infrared Spectrometer and Infrared Microscope System.

This system must be suitable for transmission, reflectivity and photoluminescence measurements of semiconductor and other samples. These measurements will be carried out from 4-300K utilizing an existing Oxford MicrostatHe rectangular tail, and at high magnetic fields utilizing a superconducting magnet with a room temperature bore.

The system must consist of the following components and shall meet or exceed the following minimum-specifications.

### **Fourier Transform Infrared Spectrometer Specifications**

- S1. The spectral range must cover from the ultraviolet down to the far infrared spectral range of  $50,000$  to  $5\text{ cm}^{-1}$  when utilized with the right beamsplitters and detectors.
- S2. The spectrometer shall be a vacuum spectrometer capable of maintaining a working pressure of less than 5mbar.
- S3. The system must have a broad range power supply with the following specifications for worldwide operation: 100-240 VAC, 50-60Hz, typically 700W including vacuum pump (without PC-data system).
- S4. The spectrometer shall include an oil-free vacuum pump with a capacity of  $14\text{ m}^3/\text{h}$ .
- S5. The instrument as well as the sample compartment must be purgeable.
- S6. The interferometer and sample chambers must be separately evacuable in order that the sample compartment may be brought up to atmosphere pressure without losing vacuum in the interferometer and detector chambers.
- S7. Optical alignments shall be maintained under both evacuated and non-evacuated operations.
- S8. The instrument spectral resolution shall be continuously variable to a maximum of at least  $0.075\text{ cm}^{-1}$ .
- S9. The mirror speed shall be continuously variable with a slowest speed of  $0.05\text{cm/s}$  or slower.
- S10. The system shall allow electrical access to both internal and external detectors, in order to send the detector signal into a lockin (and/or boxcar) and then back into the spectrometer before the ADC (Analog Digital Converter).
- S11. The spectrometer shall have an active feedback system that will allow it to scan an interferogram even when the noise level is much higher than the signal level. (for example ZPD).
- S12. All optics other than the beam splitter and non-focusing isolation windows shall be reflective.

S13. The system must include at least two internal software selectable air cooled sources: mid infrared (Glowbar) and near infrared (NIR).

S14. The sources must be easily user replaceable and must be easily accessible.

S15. The system must provide at least two software selectable output ports. One for the use of liquid He cooled detectors (such as silicon bolometers) and the other to steer the optical beam into a magnet with a built in detector. In both cases the signal from the detectors shall be fed into the ADC.

S16. The system must provide a software selectable internal detector position which can be used for detectors either room temperature, thermo stabilized, liquid nitrogen cooled or thermo electrically cooled.

S17. The detectors must be easily user changeable and must be easily accessible.

S18. The system shall include an extended KBr beamsplitter.

S19. The beamsplitter must be easily user replaceable.

S20. Optical bench must support at least two computer controlled input beams (emission port). One of these input ports shall be used to couple the infrared microscope while the other will be utilized for other external sources, photoluminescence setup, etc.

S21. Automatic sample compartment shutters must be available to allow measurements in the purged sample compartment without optical windows.

**Option 1:**

Multilayer beamsplitter, spectral range 680-30cm<sup>-1</sup>.

**Option 2:**

Near infrared/ visible/ ultraviolet broadband beamsplitter CaF<sub>2</sub>, spectral range 50,000-4,000cm<sup>-1</sup>.

**Option 3:**

Internal InSb detector, bandwidth > 20kHz.

**Option 4:**

Internal Si diode detector, spectral range 25,000-9,000cm<sup>-1</sup>.

**Option 5:**

50 μm Mylar beamsplitter, spectral range 60-10cm<sup>-1</sup>.

**Option 6:**

125 μm Mylar beamsplitter, spectral range 22-5cm<sup>-1</sup>.

**Infrared Microscope Specifications**

S22. The microscope shall be coupled (optically and electrically) to one of the input ports of the spectrometer.

S23. Shall be dry nitrogen purgeable.

S24. All reflective surfaces shall be aluminum coated to provide high reflectivity in the 50,000-5 cm<sup>-1</sup> spectral range, matching the Fourier Transform Infrared Spectrometer spectral range.

S25. The infrared microscope, when utilized with the spectrometer on the emission port, shall allow absorption/reflection spectroscopy as well as emission spectroscopy.

S26. It shall be possible to mount an Oxford MicrostatHe rectangular tail in the microscope to perform measurements from 4-300K.

### **Installation and Training**

- a. The price of the spectrometer/microscope shall include installation at NRL, Washington DC. Installation shall include a demonstration that the instrument is in compliance with the specifications.
- b. The price of the spectrometer shall include delivery of the instrument to NRL, Washington DC.
- c. At the completion of the installation and demonstration, the successful offeror shall provide one-time, on-location training at NRL.

### **Documentation and warranty**

- a. A full set of all written documentation customarily provided to the public with a commercial item shall be provided. This shall include users manual(s) or equivalent as well as copies of any software, and any manuals for the software included with the system, if customarily provided. This documentation shall be received by NRL with the system hardware, unless other arrangements are agreed to by the authorized Government representative.
- b. The contractor shall offer the Government at least the same warranty terms, including offers of extended warranties, offered to the general public in customary commercial practice. These warranty terms must be included in the system price. The period of the warranty shall begin upon acceptance.