



Ref. No. 193 (PR: 1000018006)

RFX. No.6100000897

Technical Specifications –Laser Raman Confocal Imaging Spectroscopy

Tenders under two-part bid system (technical and price bids) for the procurement of a fully automated, brand new Confocal Laser Raman Imaging Spectrophotometer having following features:

1. Raman System:-

1. A research grade confocal imaging and reflective optics capable of producing Raman Spectra in the spectral range of 50 cm^{-1} (or less) to 3500 cm^{-1} (or higher) at 532nm.
2. All necessary optics, filters, gratings required for 532 nm and 785 nm laser excitation sources.
3. The system must be class B laser safe category to avoid any safety risk and no requirement of laser specific goggles.
4. Should be mountable to Linkam stage.
5. All operational manuals/Flow charts, instrument manual, important published literature of reference should be supplied free of cost.

a. Resolution

1. Spatial Resolution: $0.5 \mu\text{m}$ or better
2. Spectral Resolution: 2 cm^{-1} FWHM or better or 1 cm^{-1} per pixel or better at high resolution

b. Fluorescence Correction

1. The machine should have software-controlled fluorescence rejection mode for all laser lines.

2. Lasers – (Qty 2):-

1. Facility to perform Polarization measurements with all the necessary accessories.
2. 532 nm laser with 20mW or better power at source with proper attenuators.
3. 785 nm laser with 70 mW or better power at source with proper attenuators.
4. Edge filters optimized for each laser
5. Grating should be compatible for the opted laser.

6. Continuous laser power attenuation must be possible in a completely automated way under software control.
7. Laser power monitoring must be software controlled with an increment of 0.1 mW or with at least 12 power levels from 0.0001 to 100 % at sample
8. Both the lasers must be user replaceable and system must automatically detect, and optimize for alignment and calibration upon replacement. Laser ON/OFF software controlled or manual operation.
9. System must support additional lasers like 455 or 633 nm and must be field upgradable and user replaceable

3. Spectrograph:-

1. Gratings need to be either fixed in case of single grating or motorized in case of multiple grating options. Gratings should not have service dependency.
2. Grating lines must be 900 lines/mm or better to achieve minimum 1cm^{-1} per pixel resolution at 532nm.
3. Spectrograph design must maintain optimum focus on CCD for all wavelengths of light simultaneously to avoid significant loss of laser power in case of no fiber optics coupling. Loss of laser power must be known in case of fiber optics coupling.

4. Microscope :-

1. A research grade Trinocular Microscope comprising Binocular and USB-PC controlled high-resolution camera for viewing with annotations for image capture
2. Microscope with a 5 turret for objectives, must have Reflected and Transmitted light with differential interference contrast (DIC) illumination kit. The system must accept reflection and transmission illumination
3. Illumination of 100W halogen or equivalent LED.
4. Objectives: 5X, 10X, 20X, LWD 50X and 100X objectives with Brightfield and Darkfield illumination.
5. Microscope should have provision for free space under the objective turret to accommodate large sample holders like cryostat, high temperature cells, etc.
6. The microscope should have an enclosure for sample/ stage

5. Confocal Raman Imaging Performance :-

1. Detector: Thermoelectrically cooled back illumination CCD with quantum efficiency above 90%.
2. Spectral acquisition rate 500 spectra/second or better.
3. Typical Raman image collection time must be less than a minute for 100 X 100 micron sample size in X and Y direction with 1 micron image pixel size.
4. Maximum Raman image collection size must be at least 100 X 75 mm.

5. High precision motorized stage with magnetic motors and optical encoders to maintain stage position repeatability within 10nm. A joystick controller must be available
6. Spatial resolution of 0.5 μm at 100x for 532nm.
7. True confocal measurements using software selectable apertures. Confocal pinhole aperture and or one slit aperture
8. Depth resolution 2 μm or better

6. Instrument Alignment and Calibration

1. Software controlled alignment for lasers, Raman emission, and visual beam paths to microscope cross hairs must be available
2. Wavelength calibration using multiple neon emission lines. Automatic wavelength calibration with fixed interval during large area Raman imaging analysis
3. Laser frequency calibration using Polystyrene and /or Silicon Raman peaks
4. Intensity calibration using white light source
5. Facility for automatic intensity correction to provide instrument independent results with all excitation lasers
6. Excitation laser power at the sample controlled by the software
7. Automated fluorescence correction

7. Software

1. The software required with 2 licensed copies
2. The software must allow chemical image definition, parameter setting, and data collection
3. The software must have provision for automated fluorescence correction to compensate for potential fluorescence in data
4. The software must have provision to account for dark current and improve spectral quality
5. The software must have advanced image analysis and processing options like Multivariate or Principle component analysis, profile generation using peak area, height etc.
6. The software must able to provide instant Raman chemical image with multiple component identification in a preview mode instead of waiting for the data acquisition to be completed. Raman image must be generated using advanced chemometric algorithms as well as Raman spectral libraries for a rapid investigation of the sample
7. The software must have option to generate 3-Dimensional image for X,Y and Z measurements
8. Advanced particle analysis software must be available. It must support automatic particle identification and analysis of visual and chemical image

8. General Accessories

1. All power supplies should be Indian type 230+/-10% Volts, 50Hz, with Indian standard plugs. If Indian plugs are not available, suitable converters must be provided

9. Computer

1. The computer must have minimum the dual-core 10 Gen processor, 64 GB RAM, Graphics card for 3D viewing, DVD-RW, 2 TB HDD, 2 USB 3 ports, Window 10(64 bit), 24-inch LED color monitor (s).
2. 03 years of manufacturer's warranty on computer and monitors

10. Raman data and libraries

1. The quoted system software (2 licensed copies) should have option to open backup file of acquired Raman data (single spectrum file, group files as well as mapping chemical image file. Those files must be able to retain data history like experimental parameter, spectral processing history etc. for further research. Raman database or libraries especially suitable for geological samples with minimum 1000 spectra (inorganic and minerals), should be provided Libraries should be permanent. Mention the company name where an additional library can be acquired

11. UPS

1. Suitable advanced online UPS with at least one-hour backup. UPS should come with a warranty of two years

12. Warranty

1. The warranty on the system must be at least five-year with laser warranty of two year from the date of installation. All parts, labor and travel must be included in the warranty and at least three maintenance/breakdown service per year should be provided. AMC will be done after the warranty period is completed.

13. Installation

1. Installation and commissioning at the site. All expenditures to be borne by the vendor
2. Vendors should include their tender, provision for maintenance tools and initial stock of maintenance spares as are essential for the proper operation and maintenance of the equipment.
3. The vendor should be fully responsible for the manufacturer's warranty in respect of proper design, quality and workmanship of all the equipment accessories etc. covered by the tender

4. The vendor should have trained service personnel to provide efficient after-sales service support. Names of three personnel, along with their training certificates, should be furnished along with quotation
5. Trained Service engineers in India or directly from OEM must be available to resolve technical problems within a week
6. Door to door duty delivery paid for all components. IIT Bombay will provide the exemption certificates as applicable

14. Demonstration

1. The supplier should demonstrate with reproducible Raman spectra along with 2D and 3D mapping of at least three user supplied samples with a typical dimension of 25mm x 45mm