INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION

PR NO. 1000051362 **RFX No. 6100002511**

Technical specifications for Low Temperature Hetero-structure characterization and Analysis (1 Unit)

- We need Customized Open frame gantry architecture modular fluorescence decay measurement spectrometer with Near UV fiber-amplified pulsed laser source capable of single point analysis and imaging system with time domain measurement feature enables multi-modal performance including micro-spectroscopies at temperatures down to < 6K with following specification.

Sr. No.	Description	Value / Range	Technical Compliance (YES / NO)	Additional Information (if any)
a.	**Spectrometer Specifications:**			
a.1	High resolution 320mm or more focal length single cast housing imaging spectrometer for better stray light rejection (stray light rejection $1.0x10^{-5}$) to be integrated with the system.			
a.2	The spectrometer must feature a toroidal mirror to correct astigmatism and improve image quality.			
a.3	Spectral resolution with proper grating: 0.06 nm at 500nm or better.			
a.4	Aperture: f/4.1 or better			
a.5	Wavelength accuracy of ± 0.20 nm and repeatability: ± 0.075 nm or better.			
a.6	Spectral dispersion must be (500nm) 2.31 nm/mm or better and scan speed 160 nm/sec.			
a.7	Gratings must rotate on the front surface axis for constant and accurate focus on grating (An off-axis design is not allowed.)			
a.8	The grating turret must be interchangeable and kinematically mounted. Each computer-controlled turret must be capable of holding up to three gratings			
a.9	Three gratings (600 g/mm & or 1200 g/mm or 1800 g/mm) to cover wavelength range 240-1000 nm			
a.10	Grating size: minimum 68 mmx 68 mm for high throughput.			
a.11	Automated slit control and grating turret control are required from 2 micron to 7 micron for better resolution.			
a.12	Spectrometer must have two entrance and two exit ports such that one pair of entrance/ exit available for steady state and the other for time domain measurement.			
a.13	Free space excitation coupler from Laser to microscope and emission coupler for microscope to the spectrometer should be provided to avoid signal loss.			
a.14	The spectrometer must have a flat image field at the detector chip of 30mm x 12mm or greater and an array adapter compatible with the industry-standard spectroscopy flange of 3 holes at 120 degrees on a 3.60-inch bolt circle.			
a.15	Motorized swing away mirror at exit must be included for dual use of spectrometer to measure at wavelength domain or time domain respectively.			
a.16	A Filter Module, holding excitation and emission filter optics - Universal Microscope spectroscopy Adapter should be given to integrate with the microscope platform			
a.17	Beamsplitter 50/50, UV 12.5 MM DIA must be included			

a.18	The spectrometer must have USB interface with one or more hub port.		
b.	**Microscope and Mapping stage Specifications**		
b.1	Open frame modular Microscope with mapping stage should be included as part of system for both single point and 2d mapping.		
b.2	Vision camera for sample imaging must be available.		
b.3	50X LWD visible objective, NA = 0.50 WD = 10.6 mm must be included for single point spectra & imaging at liquid Helium (< 6K) temperature.		
b.4	XY motorized stage (X ≤75mm, Y ≤50mm) adaptable to the microscopes and system software		
b.5	XY specifications: repeatability ≤ 1µm ; accuracy ±3µm ; resolution (minimum step size = 50 nm.		
b.6	Joystick and suitable controller for sample positioning.		
b.7	The stage should be raised from the optic bench platform and provide window for probe integration		
c.	**Detector Specifications**		
c.1	The array detector must use a 1024x256 pixel Open-Electrode Technology CCD chip with 26um x 26um pixels and overall format of 26.6mm x 6.6 mm,100% fill factor		
c.2	The array detector must be Deep thermoelectric cooling, thermoelectrically air cooled to nominally -80^{o}C or lower in standard ambient lab conditions (22^{o}C) with no other cooling assistance or fluids.		
c.3	Pixel well depth: 450,000 e		
c.4	e2V Scientific Grade 1 CCD		
c.5	Image area: 26.6 mm x 6.7 mm, 100% fill factor		
c.6	The array detector must have a dark current no greater than <0.002 e-/pixel/sec (-80^{o} C)		
c.7	The CCD array detector must exhibit peak Quantum Efficiency 56% or better		
c.8	A computer-controlled shutter must be included that is mounted in the optical path prior to the grating to avoid temporal vignetting in the wavelength dimension (the shutter must not be mounted in front of the CCD array)		
c.9	TCSPC Electronics and Controllers must be capable of handling laser pulse repetition rates of up to 100MHz for fast measurements		
c.10	Integrated single-photon detection module with integral constant- fraction discriminator (CFD), regulated high voltage bias, and 1 GHz pre-amplifier		
c.11	Photomultiplier spectral response: 230 nm-850 nm; Efficient photon counting in UV and visible		
c.12	Transit Time Spread ≤180 ps		
c.13	Cooling-Thermoelectric (Integral)		
c.14	Dark counts <100 cps (Typical)		
c.15	Simultaneous NIM and TTL outputs from detection module		
c.16	Stand-alone diode controller module used with interchangeable, hot-swappable, diode heads must be given		
c.17	Automatic adjustment of rep rate to match TCSPC time range		
c.18	System must include all assembly components, adapters, controllers, power supplies, delay boxes, software, cables, and connections required for microscope integration, steady state PL, and TRPL		
d.	**Laser Specifications**		

d.1	Laser diode source with peak wavelength 405 nm +/- 10 nm or better.		
d.2	Power: 50mW		
d.3	Power adjustment range 0 to 100%		
d.4	It should have Auto Power Control and Auto Current Control options.		
d.5	Power stability over 8-hour, temperature within +/-3°C ± 0.5% or better.		
d.6	Corresponding filter set to be supplied.		
d.7	Periscope module for additional laser wavelength excitation must be supplied.		
e.	**Laser Train**		
e.1	Multi-laser train system with motorized mechanism for laser switching. Extendable up to 4 lasers.		
e.2	Provision to integrate user supplied laser		
f.	**Low Temperature Accessory specifications**		
f.1	Continuous flow cryostat which includes liquid helium transfer line with flow control valve and ice filter, cryopump, vacuum shroud with electrical feedthrough and evacuation valve, radiation shield, 1" diameter quartz window, gold-plated OFHC copper sample holder, silicon sensor at control heater, 50L LN2 dewar		
f.2	Suitable temperature controller with cable		
f.3	2-stage rotary-vane vacuum pump including convection vacuum gauge with digital display, LN2 cold trap, 5' S/S pumping line, clamps, and centering rings		
f.4	Adapter plate for mounting to x-y stage		
g.	**Software**		
g.1	Latest software should control spectrometers, detectors and other accessories		
g.2	A fully integrated data acquisition and data analysis software for single point analysis and mapping photoluminescence (PL). Provision for TRPL data acquisition, processing, analysis, and display of data must be supplied with the system. The software should provide intuitive control of spectrometers, detectors (offering simultaneous detector control), and accessories. Software should be compatible with the temperature accessory. Also, the system must have option for software upgrade for writing software code to incorporate the components into according to other applications integrations.		
h.	**Laser**		
h.1	Fiber-amplified Pulse laser at 355+/- 2nm		
h.2	Power >7 MW at 80 MHz		
h.3	Power stability: 0.5% RMS over 10 min		
h.4	Pulse duration 80-100 ps (FWHM)		
h.5	Spectral width <0.2 nm		
h.6	Resolution rate: Pulse on demand to 100 MHz		
h.7	Power stability: <1 µrad		
h.8	Polarization excitation ratio <20 dB		
h.9	Beam quality: Multi mode fiber output		
h.10	Filter for filter module: 355 nm filter set, 1/2 inch		
h.11	Beamsplitter for filter module: 1/2-inch broadband		
i.	**Microscope Adaptor**		
	Universal microscope spectroscopy adapter must be offered for direct and fiber coupling options.		
j.	**PC**		
	Suitable PC with display to be supplied		
k.	**System qualification criteria**		

k.1	The system shall include calibration facilities using a **reference sample.**		
k.2	The system shall enable **micro-PL mapping** on samples **up to 1 inch (25 mm) in diameter across a 6 K to 475 K** temperature range with Cryo set points 0.01 deg resolution above 99.999K and 0.001 deg resolution below 99.999K.		
k.3	The system should allow for **spatially resolved PL mapping** with micron-level resolution.		
k.4	With CW laser, should have better than 5 µm spatial resolution for PL mapping with Step size 50 nm using 50x objective. Spectral resolution (in 400-700 nm range) with @ 1800 gr/mm grating resolution better than 0.12 nm @ 1200 gr/mm grating, resolution better than 0.18 nm @ 600 gr/mm resolution better than 0.4 nm		
k.5	The system shall be capable of **TRPL measurements** on samples **up to 1 inch in diameter**, across a **6 K to 475 K** temperature range.		
k.6	It should be able to **measure lifetimes** in the range of **200 picoseconds (ps) to 1 millisecond (ms)**. And the **Instrument Response Function (IRF)** will be measured and documented to validate the minimum measurable lifetime.		
k.7	Software should be provided for both PL and TRPL data acquisition and analysis.		
k.8	The design should ensure minimal drift during long-duration temperature-dependent measurements		
j.	**Warranty**		
	1 year from Installation.		