Detailed Specifications of Open Tender Notice No: 03/2013

S. N.	TENDER NO.	BRIEF DETAILS OF ITEM(S)	PAGE NOS.
1.	14-III/JPT(461)12-PB/T-08	Emission Lifetime (PL Decay) measurement set –up for films and solids.	2-3
2.	14-VII/JPT(2379)12-PB/T-09	Impedance Analyzer interfaced with a low temperature cryostat	4-5
3.	14-IV/SSK(56)13-PB/T-10	UHV system for MgB_2	6-9

Emission Lifetime (PL decay) measurement set-up for films and solid

Technical Details

Standard emission lifetime (PL decay) system having time correlated single photon counting (TCSPC) with following specifications are required

Diode Laser

Interchangeable pulse laser diode (375, 450 and 650 nm) with pulse width ≤100 ps and LED based for 280 nm with pulse width ≤1 ns. Motorized emission monochromator should cover the wavelength 200-800 nm

Excitation and Emission polarizer

Excitation and Emission polarizer must be fully computer controlled so that parallel and perpendicular decays can be collected with respect to excitation of the sample for anisotropy measurement. The position of emission polarizer must be recognized by the computer. The dark count should be very much low for anisotropy measurement. All the necessary interface circuitry along with computer should be provided.

Detector

A cooled PMT with very low dark count (typically 10-20 counts/sec) and good signal to noise ratio with interlocked shutter system.

- spectral range : 250-800 nm
- detector response width ≤ 100ps
- dark count rate : ≤100 cps at $0^{o}C$

The detector should have the provision of auto-shutdown in case of large counts to prevent the damage

Data acquisition, control and analysis software

1) All the software should run on the PC having window 7 or higher platform.

2) Online as well as offline data analysis software comprising of the following features should be provided
   a) Full reconvolution analysis
   b) Fitting routine for the determination of multiple decay times (exponential non-exponential life time distribution)
   c) Non-linear least square reconvolation techniques using well known Marquardt-Liebenberg procedure.
   d) Chi-square test for goodness of fit
   e) Must be able to export data in ASCII format

3) Offline data analysis software should run on the different PCs with windows 7 or higher platform

Cuvette holder and cuvettes

The cuvette holder must have the facility to hold the filter slots. At least eight cuvettes are required with the instruments

- Quartz fluorescence cell with PTFE stopper – 2-10 mm path length (5 Numbers)
- Front surface sample holder for use with solid or highly scattering samples. Adjustable positioning in two axes allows optimized alignment
- Complete set of filters and polarizes.

Optional:

- Peltier controlled cell holder with magnetic stirrer on quick-interchange flange. Samples temperature -25 to 105^0 C. Water coolant and gas purge required for low temperature operation.
- Additional pulse laser diodes and LEDs.
- Single cuvette holder of (1 cm x 1cm) cuvette with the facility to circulate water or liquid for temperature controlled by water/other liquid circulation.

Note:

1. **Operating manuals**: the system should be supplied with the operating manuals

2 .**Warranty:** at least two years comprehensive warranty from the date of installation

3. Installation, demonstration and training of the system at consumer place

4. List of users where the above equipments supplied

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Impedance analyzer interfaced with a low temperature cryostat

Technical Details

1. Impedance Analyzer

High performance dielectric Impedance Spectrometer with GPIB interface card and software having provision of direct display of permittivity, conductivity, inductance, Bode, Cole-Cole plots, Havriliak-Negami relaxation etc with compatible computer along necessary interface and cables. The system should have the features listed below

Frequency Response analyzer, 3μHz–40MHz, High performance dielectric spectrometer with analyzer

Frequency range Gain Phase mode: 3μHz-40MHz

Frequency range Impedance mode: 3μHz-40MHz

Measuring voltage range: 0-3 Vrms /70 mA

Impedance Range : 0. 01 Ohm -100T ohm

Capacitance range: 0. 01pF-1F

Turnkey high performance system

F = 3 μHz-.....40MHz

Measuring voltage: 0...3 Vrms/100mA

Dc-Bias Voltage : ± 40V /70mA

Impedance range 0.01Ω ...100 T Ω

Capacitance range: 0.01 pF ... 1 μF

Tan Delta Resolution: 10^{-5}

2. Low Temperature (77K-600K) Probe Station

Probing station for I-V and C-V measurements of organic thin films with following specifications

1. Biasing through coaxial cable
2. Four external manipulators with XY movement ≥ 25 mm and Z ≥ 5 mm for each independently controlable with positioning accuracy ≤ 50 micron.
3. Temperature Range of 77-600 K
4. Temperature controller with temperature stability ≤ 0.1 K with temperature response of ≥ 1K/sec.
5. Measurement under inert gas atmosphere
6. Microscope with CCD Camera for display
7. Gold coated needle with pointed and blunt ends (2 sets of 4+4 needles).
8. BNC connector to the end of the needle
9. Vacuum ~$5x10^{-3}$ Torr
10. Sample size up to 10 mm x 12 mm.

Note:

1. **Operating manuals**: the system should be supplied with the operating manuals
2. **Warranty:** at least two years comprehensive warranty from the date of installation
3. Installation, demonstration and training of the system at consumer place
4. List of users where the above equipments supplied

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UHV System for MgB_2

Essential Specifications:

Dual chamber system, one main growth chamber attached to the load lock cum preparation chamber:

A. Main Growth Chamber:

A1. 22" diameter UHV Growth Chamber capable of vacuum better than 1×10^{-10} Torr made of 316 SS with the following provisions :

i. Five bottom ports: Four ports for effusion cells (K Cells) [three active one equipped with effusion cells and power sources (see A3 below for specifications), one blank port] and one view port with integrated shutter in the center for Pyrometer.
ii. One port for e-beam sources in a line [two of such lines with screen in between] (See detailed specifications of these in A4 below)
iii. One port for RHEED gun and another port for RHEED fluorescence screen with manual shutters
iv. Three ports for quartz crystal monitor (two fixed and one with linear shift).
v. One port for Residual Gas Analyzer.
vi. View ports with manual shutter in convenient locations for viewing K-cells, e-guns and sample transfer.
vii. Chamber should be connected to an Ion pump of minimum capacity 400 l/s for N_2 gas.
viii. Chamber should be connected to Titanium sublimation pump of minimum capacity of 1000 l/s for N_2 gas with supply electronics.
ix. Compatible Turbo molecular pumps [Quantity: two] of minimum capacity 400 l/s for N_2 gas with backup dry pump connected to chamber through isolation gate valves. One turbo molecular pump will be shared with load lock cum preparation chamber.
x. Two ports for the vacuum gauges, blank for unused port.
xi. One vent valve with precision (UHV bake-able).
xii. Chamber must include all necessary manifolds for water cooling of K-cells, e-guns etc and the pneumatic control of shutters, gate valves and gases.
xiii. Chamber to include vacuum safety interlock system.
xiv. High accuracy vacuum gauges with electronic control and read out to measure pressure from atmosphere to 1×10^{-11} Torr.
xv. All sources (K-cell and e-guns) should be at the same focal plane.
xvi. Chamber and components should be bake-able at $\geq 125\ ^{\circ}C$.

A2. Substrate Stage:

i. Substrate holder platform must be designed to be UHV compatible with provision for Z displacement (± 5 cm or higher).
ii. Platform must include IR heater capable of reaching temperatures $\geq 850\ ^{\circ}C$ with PID programmable temperature controller and sensor (thermocouple) and indicator with power supply and cables.
iii. Substrate holder platform should have LN_2 cooled with copper support.
iv. Substrate rotation (continuous 360° rotation, variable rate from 0-30 RPM required both at the maximum as well as minimum substrate temperatures)

v. Thermal shielding for the heater to protect chamber walls from heating
vi. Appropriate substrate shutter
vii. Distance between K-cell, E-gun assembly to substrate stage ≥ 30 cm.
viii. One gear control mask manipulator (mask with x-y aligner) attached to the copper plate which can attach/detach mask from sample at sample holder platform. Provision for adjusting the gear control from outside the chamber is mandatory.

A3. Three Effusion cells with Three Quartz crystal monitors:

i. Three water cooled effusion cells: Each effusion cell should have single filament with K-type thermocouple with crucible size ≥ 15 cc which should go up to 1200 °C with variations ~ 3 deg C or lower.
ii. All K-cells must be designed for use in pressure ≤ 1×10^{-10} Torr.
iii. All K-cells must include all control power supplies, PID controllers and cables.
iv. Three quartz crystal monitors for all K-cells with all electronics and cabling.
v. All K-cells should have integrated computer control shutters.

A4. E-guns with power supplies (2 No):

i. Two E-guns (on the same compatible flange running parallel to one another side by side) with water cooling system along with individual power supply for each e-gun.
ii. Each E-gun of multi-hearth (3 pockets in each line with crucible capacity ≥ 7 cc) with suitable shutters.
iii. E-guns with max power 3KW and evaporation rate ≥ 2Å/s.

A5. Magnetic transfer system: Transfer rod should be able to carry > 1" diameter platen with 1" diameter substrate and mask. It should also be able to transfer sample to load lock and main chamber with port aligner arrangement.

B. <u>Load Lock cum Preparation Chamber:</u>

B1. 10" diameter suitable Load Lock cum preparation chamber capable of vacuum better than 1× 10⁻⁷ Torr made of 316 SS with the following provisions:

i. Load lock should have view port on hinges and O-ring seal.
ii. Chamber should be connected to one of the Turbo molecular pumps (shared with growth chamber) with backup dry pump with bypass gate valve.
iii. Suitable ports for pumping, gauges, view port, gas inlets (with bellow sealed gas valve).
iv. Three bottom ports: Focal points of all three ports should be at sample position. Two bottom ports for ion sputter guns and one bottom port for O_2 cold cathode gun
v. One bottom port with 1" dia rf UHV sputter gun with inbuilt shutter. Sputter source should have the power supply with ≥ 500 W power, precision gas inlet, matching network, cabling and mass flow controller.
vi. One quartz crystal monitor, with all electronics and cabling.

vii. One sample holder platform (provision of IR heating the sample at temperature ≥ 850 °C with PID programmable temperature controller and sensor (thermocouple) and indicator with power supply, provision for z-displacement (± 5 cm or higher) along with gear control mask manipulator (mask with x-y precision aligner) attached to the copper plate. Provision for adjusting the gear control from outside the chamber is mandatory.

viii. Precision leak valve for N_2 gas (UHV bake-able)

ix. Suitable vacuum gauges and controller with digital readout to measure pressure range from atmosphere to 1×10^{-9} Torr.

x. UHV gate valve to isolate the main growth chamber from load lock.

xi. Chamber and components should be bake-able at ≥ 125 °C.

C. Other Equipments/components:

i. System to include instruments rack for housing all electronics and cables necessary for vacuum and growth/deposition of the material.

ii. One PC with latest configuration installed with Windows XP Pro OS or later version, and 19" LCD bright view monitor, loaded with software for controlling the substrate rotation, shutters and other system.

iii. Compatible water chiller for cooling e-guns, K-cells etc.

iv. System to include all bake out equipment (fan heater, bake out controller, jackets etc) for baking system at ≥ 125 °C and bake-time adjustable to few hundred hours. Arrangements for uniform temperature distribution with thermocouple reading at multiple points.

v. Appropriate frames to mount the system and provision for mounting accessories and TMP, etc.

vi. Interlocking provision in the system for the safety and immediate shut down.

vii. Platens to hold substrates of following dimensions: 1" dia and 1 cm × 1 cm (Each 3 Nos.).

viii. Installation, operation and training to users at NPL (CSIR-India) site.

ix. At least 1 year of comprehensive warranty after successful installation, operation and training.

x. All power connections as per Indian electrical standards.

D. Firm shall supply:

i. Supplier should provide one set of all required consumables (Gaskets, O-rings, etc) and spare parts (like blanks, view ports etc) for the system and components.

ii. Complete mechanical tool kit required for the maintenance of the system should be provided.

iii. The list of customers (India and abroad) with contact details should be provided.

iv. All operational, user and maintenance manuals as well as all technical drawings and layouts shall be supplied

E. Guarantees:

i. System should be tested for all items (sources, power supply, vacuum etc) and for growth of MgB_2.

ii. Deposition Uniformity for MgB_2: Better than ± 1% over ≥ 1" diameter Si(111) wafer.

iii. Base Vacuum: ≤ 1.0×10^{-10} Torr in growth chamber and ≤ 1.0×10^{-8} Torr in load lock chamber.

Optional items (Quote separately):

1. Complete Software package and compatible hardware for automatic control and growth of the materials.
2. UHV compatible Pyrometer for temperatures ranges 150 to 1200 °C, Resolution ± 0.5 °C, measurement time ≤ 1sec.
3. One Residual Gas Analyzer (0-200 a.m.u.) with control electronics, computer (Windows 8OS) with suitable software and cablings.
4. One O_2 cold cathode gun.

General:

i. All shutters made of Tantalum /Molybdenum material.

ii. All metal gate valves should be UHV compatible and manufactured by VAT.

iii. All components and accessories should be UHV compatible and bake-able.

iv. Compatible hardware for automatic control of the system and growth of materials.

v. Firm has to ensure availability of spare parts for next five years.

vi. All vacuum pumps should be of reputed firms with 2 year warranty.

vii. Service/repair of any items in the system should be taken care from principal supplier in warranty period.

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