



# PONDICHERRY UNIVERSITY

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## Tender Notification

**Sub:** Pondicherry University- Supply & Installation of following equipments under Department of Science and Technology –Clean Energy Research Initiative (DST-CERI) funded project -Sealed Quotations called for – reg.

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Sealed quotation are invited from reputed manufacturers / authorized dealers of reputed manufacturers for Supply & Installation of following equipments as per following specifications

### LIST OF EQUIPMENTS:

Sr.No	Name of the equipment	Quantity
1.	<b>Dry box system with humidity control integrated with both spin coating unit and thermal evaporation unit</b>	<b>1</b>
2.	<b>Ultrasonic spray pyrolysis and their accessories</b>	<b>1</b>
3.	<b>Computer controlled Electrochemical Works Station (Single Channel Potentiostat Galvanostat with EIS software)</b>	<b>1</b>
4.	<b>Spin coater</b>	<b>1</b>
5.	<b>Newport IPCE/EQE measurements and their accessories [for existing New port Solar simulator (Model number: 67005) with Keithley 2400 Sourcemeter in our PI lab at Pondicherry University]</b>	<b>1</b>

### 1. SPECIFICATIONS FOR DRY BOX SYSTEM WITH HUMIDITY CONTROL INTEGRATED WITH BOTH SPIN COATING UNIT AND THERMAL EVAPORATION UNIT

The Dry Box system with humidity control integrated with (i) spin coater and (ii) thermal evaporation unit should be designed, fabricated, tested and supplied as per the tender specification. The system should essentially consist of:

#### DRY BOX SYSTEM:

The Dry Box should be made as per our specification.

- Automatic Pressure and **Humidity Controller** at a preset level.
- Tube Lights fixed outside the chamber.
- Non-obstructing Sliding Door for the Ante-Chamber.

- Removable glass on the front side.
- Easy door locking for the Ante-Chamber
- Chiller for continuous dry box operation

The Dry chamber is fabricated out of Stainless Steel **1.4301 (US type 304)** (non-magnetic) material with dimensions of **780mm (D) x 920mm (H) x 1450mm (L)** and a Toughened Glass Window fixed on the front side as per the specifications listed below.

- The Chamber should contain **3 ports** of **8"** size with high quality butyl gloves with sufficient length to handle the materials inside the chamber. It must be designed for maintaining water pressure above atmosphere with inert gas/nitrogen.
- Pressure sensor should be provided on the top of the chamber. Facility for admitting working gas must be provided.
- Dry Box should be fixed on a MS frame **neatly painted and placed at the convenient height.**
- Pressure Relief Valve should be provided for protection to release the gas pressure, in case if it is above the set level.
- The main dry box should be pumped to vacuum and purged with inert gas racks for storage of materials/instruments should be provided inside the chamber. Racks should be made of Stainless Steel.

#### **ANTE CHAMBER:**

- The Ante-chamber should be designed for vacuum of the order of  $10^{-2}$  mbar and the vacuum could be measured with pirani gauge. Ante-Chamber proved with door to main glove chamber to enable easy transfer of material.
- Tube light should be provided for lightening inside the chamber. It should be fixed at the top of the chamber.
- Front side of the Glove chamber should be covered with toughened glass sheet for easy viewing the material inside the chambers.

#### **ISOLATION VALVE:**

- 1" Quarter swing Butterfly type stainless steel non-magnetic valve should be provided in the vacuum line and it must be able to be operated manually.

#### **VACUUM PUMP:**

A Direct Drive Double Stage Rotary Pump of 250 lit/min capacity should be connected to both dry Box and Ante Chamber through isolation valve and SS bellow and pipeline. The specifications for the Rotary Pump are given below:

#### **Salient Features:**

- Direct drive
- Air cooled.
- Less oil charge.
- Compact and rugged.
- Light weight.
- Gas ballast.

- Less noise and vibration.
- Built in Ante suck back facility.

### Specifications:

Free air displacement capacity	: 250 lit/min (15M3/hr) 8.9 CFM
Ultimate vacuum at the intake with Mecleod Gauge (With Gas ballast Closed)	: $1 \times 10^{-3}$ mb
Vacuum connection	: KF-25.
Motor H.P.	: 1/2 H.P Single Phase
Cooling	: Forced air cooling
Pump rotation speed	: 1440 rpm
Vacuum with gas ballast open	: $5 \times 10^{-2}$ mb.
Oil temperature	: 55°C after 7 hours.
No. of stages	: 2

### Vacuum Measuring Gauges:

Digital Pirani Gauge should cover pressure ranging from 999 mbar to  $1 \times 10^{-3}$  mbar. Range with high resolution.

### Features:

- Extremely fast response time.
- Covering range should be from atmosphere to  $10^{-3}$  mb.
- Rugged construction of sensors.
- Digital Display.
- Built in controller set point and many more.

### SPECIFICATIONS:

Measuring range	: $1 \times 10^{-3}$ mbar to 999 mbar. (N <sub>2</sub> Equivalent)
Display	: 3 digit 7 segment filament LED display
Resolution	: 1 digit of display bellow 1 mbar
Response time	: 200 m seconds
No. of gauge heads	: One
Recorder output	: 10 volts recorder output
Operating temp. range	: 10 to 85° C
Bridge voltage	: 2.5 V to 12.5 V approx
Process control relay	: DPDT, 2A at 230 VAC resistive load
Power	: 10W nominals
Main supply	: 230V, 5 Amps, 50 Hz
Control unit size	: 113 W x 135 H x 250 D
Cable length	: 2 meters

Also a dial Gauge covering the range (-1 to 4 bar) should be provided apart from the digital pirani gauge for vacuum/pressure measurement in the chamber.

## TRACE OXYGEN ANALYSER:

- Trace oxygen analyser system should be provided for continuous monitoring of oxygen at ppm level in dry boxes maintained in argon/nitrogen gas at near atmospheric pressure.
- Oxygen Analyzer System in Remote Diffusion Sensor Configuration, with 5 Meter 'Cable Connected Sensor' with Housing, Connected to Mains 220 V
- Operated CONTROL MODULE, with Digital Display and Controls for SPAN/CAL and ALARM.

### Specifications:

PRINCIPLE	: Galvanic Cell
RANGES	: 0 – 199.9 PPM, Resolution: 0.1 ppm 0 -1999 PPM, Resolution: 1 ppm 0 - 30% for Air Calibration.
SAMPLE	: Diffusion Mode
ALARM	: 0-100 Or 0-1000 PPM as per Range Setting, with front panel setting and Direct reading Dial.
ALARM OUTPUT	: Visual on panel and 1P2W Relay contact on back panel
RECORDER O/P	: 0-1 vdc standard; 4-20 mAdc optional
POWER	: 220 V A.C. Operated

### SOLVENT TRAPPER:

The solvent trapper should be designed to safely remove harmful solvent vapor from the dry box atmosphere. Harmful solvent vapors can affect the ability of the dry box to properly maintain low levels of oxygen and moisture. The solvent trapper should absorb harmful solvent vapors, keeping the dry box system running at optimum levels

Max. Pressure	: 0.5 bar
Integral Leak Rate	: 1x10 mbar I/sec
Filling Amount	: 5kg activated charcoal, type A
Capacity:	: max. 140 g solvent per kg activated charcoal
Withdrawal	: Solvents, hydrocarbons, gasoline, benzl, kerosene, butyric acid, chloroform

### Side Door:

Side door of the main chamber away from anti-chamber should be fully openable with suitable locking arrangement to facilitate transfer of **Big instruments** inside the dry box if required.

### Pressure Gauges:

6” Size dia Gauge suitable for both vacuum and positive pressure measurement and also a electronic pressure sensor with controller should be provided.

### Ports:

Two windows should be present on the front side for Gloves - one side port with flange for Ante-chamber fixing and one at the backside for taking power supply leads inside dry Box. Dry ports should be provided with special arrangement such that both inside and outside of the gloves are evacuated during pumping.

**Ante Chamber:**

The dimensions should be of **390 mm dia x 600 mm length** with vacuum gauge. Material SS 304 should be provided with hinged door.

**Mini ante chamber:**

The dimensions should be of **150 mm dia x 300mm length** with vacuum gauge.

**Electrical Feedthroughs:**

6 No. electrical feedthroughs should be provided to carry 230 Volts, 15 Amps supply inside the dry box.

**Electrical Power inside dry Box:**

3 Points of 5A and 1 point of 15A 230 V points should be provided inside the chamber.

**Safety Precautions:**

Adequate safety precautions should be taken for the smooth functioning of the unit. The unit should be provided with pressure relief valve and the electrical connections must be provided through fuse etc.

**Inter Connecting Piping:**

The main pipes connecting the vacuum pump to main chamber and Ante-chamber should be of 1" diameter flexible hose with KF-25 coupling.

**Valves:**

Solenoid operated valves to isolate pump from dry Box and antechamber should be mounted outside the chambers. Also, solenoid controlled valves should be provided for back filling to dry box and antechamber.

**Flanges:** All 'O'ring sealed flanges should be machined flanges.

**Port Connections:** All port connections should be KF couplings only.

**Weldings:** All weldings must be done by TIG Argon welding.

**Mounting Stand:**

Constructed of all welded steel tube, these stands should be specially designed to support dry boxes. Powder coated/Epoxy finished steel tube of 2" square forms the mounting frame. Frame must be provided with jacking facility and level adjustment features on caster rollers.

**Leak Test:**

Whole Dry box should be leak tested after fabrication and assembly.

The Ante-chamber must be evacuated to ultimate vacuum and assured for vacuum attainability up to  $10^{-2}$  mb.

**Pressure Test:**

The chamber should be pressurized by feeding dry Nitrogen and the reading must be observed for 24 hours' duration. The reading should not fall below 5-10% of the original value.

**Chiller:**

A chiller recirculation should be provided for continuous dry box operation.

**Specifications:**

Temperature range	: +5 to + 30 °C (Setting range)
Accuracy	: +/- 2
Cooling capacity	: ~1000 W @ 30°C (ambient temperature)
Flow rate (cooling fluid)	: up to 12 litre/min

**Note: The provision should be provided for the integration of spin coating and thermal evaporation systems in the dry box.**

**(i) SPIN COATING UNIT FOR DRY BOX SYSTEM**

In the spin coater the angular speed of the substrate, acceleration/deceleration and the coating duration should be set to suit the user requirement using the keyboard and the LCD display in the front panel. The process should be broken into nine steps maximum, each step having different values of speed, acceleration/ deceleration and coating duration. The spin coater should be separated from the control panel which could be placed outside the dry box.

**Specifications:**

User Interface	: 24 × 4 Line Alpha-numeric LCD and 16 button keyboard
Actuator	: Brushless DC servo motor
Program Memory	: 9 programs with 9 steps for each program
Speed Profile	: Speed, Duration and acceleration
Spin Speed	: 60 – 10,000 rpm
Speed Resolution	: 1 rpm
Speed Accuracy	: +/- 1%
Acceleration/Deceleration	: 10 - 2000 rpm/s (Ramp and dwell times should be set by entering acceleration)
Duration	: 1 - 99 sec/min/hour for each step
Sample Chucks	: 4 Nos. (10 mm, 25 mm, 32 mm & 45mm)
Maximum Sample Diameter	: 100 mm
Minimum Sample Diameter	: 13mm
Bowl Material	: Nylon
Bowl Size	: 8 inches (Lid with transparent window and sample dispensing port and safety interlock to prevent spinning when the bowl is open)
Sample Holder	: PTFE disk with silicon rubber 'O' ring
Sample Mounting	: Secured by vacuum holding
Vacuum Connector	: 8 mm dia Snap-in hose connector
Dimension (mm)	: 400 (L) 275 (W) 350 (H) mm
Power Input (Factory set)	: 230V/110V 50Hz/60Hz

Maximum Power Consumption : 260W (With vacuum pump)

Drainage hose

Nitrogen/Inert Gas Inlet

Vacuum pump On/off and Release Switches

### **Vacuum Pump Specifications:**

Oil free

Max flow rate : 45 litre/min

Max vacuum : 27 inches Hg

Max Pressure : 60 psig

Powder : 1/4 hp

Dimensions : 300 x 130 x 200mm

**Note: The spin coating system should be compatible with space provided in the dry box and mounted below the working platform of the dry box**

### **(ii) THERMAL EVAPORATION UNIT FOR DRY BOX SYSTEM**

**It should essentially consist of:**

- High vacuum pumping module.
- 300mm × 350 mm chamber with water cooling facility.
- Base Plate fitted with 2 sets of LT and 1 No. of HT Electrodes.
- Facility for Ion Cleaning.
- Substrate heater
- HT & LT Power supplies with variac.
- Digital thickness monitor

The thermal system should have a specially designed Diffusion Pump & fitted with Liquid Nitrogen Trap ensuring clean vacuum and rapid pump down cycle.

**The details are given below as follows:**

#### **High Vacuum Pumping:**

The High Vacuum system should be built with 4" size diffstack type of diffusion pump suitable for general pumping of gases in any chamber. The basic system should be capable of giving the vacuum of the order  $10^{-6}$  mb. The system should contain Rotary Vane Type Mechanical Pump, Oil vapour Diffusion Pump and necessary valves. If the Liquid Nitrogen Trap is filled with Liquid-N<sub>2</sub> the system should give  $10^{-6}$  mb.

One Analog Combined Pirani-Penning Gauge should be provided for monitoring vacuum of Backing, Roughing and High Vacuum. The complete system should be assembled on a compact frame, which should be mobile with caster wheels.

#### **Salient Features:**

- Ultimate vacuum of  $10^{-6}$  mbar range.
- Manually operated valves for easy operation and reliability.
- System should be assembled on castor wheels for easy reliability.

- Low back streaming with cold trap.
- Safety interlock.

### Rotary Vacuum Pump:

#### Salient features:

- Direct drive
- Air cooled
- Less oil charge
- Compact and rugged
- Light weight
- Gas ballast
- Less noise and vibration
- Built in anti suck back facility

### Specifications:

Free air displacement capacity	: <b>250 lit/min (15M<sup>3</sup>/ hr.)</b>
Ultimate vacuum at the intake with Mecleod Gauge (With Gas ballast Closed)	: 1x10 <sup>-3</sup> mb
Vacuum with gas ballast open	: 5x10 <sup>-2</sup> mb
Vacuum connection	: KF-25
Exhaust port	: KF-25
Motor Power	: ½ HP, Single- Phase. (230V/AC 50 Hz.)
Cooling	: Forced air cooling
Pump rotation speed	: 1440 rpm
Oil temperature	: 55 <sup>0</sup> C after 7 hours
No. of stages	: 2
Oil Capacity	: 0.75 lit
Seal material	: Viton
Noise level	: 60 Db
Overall dimension LBH	: 500 x 132 x 250mm
Weight	: 26 kg

### Diffusion Pump:

Size	: 4"
Pumping Speed	: 500 lit/sec (Unbaffled pumping)
Ultimate vacuum	: Should be ≥ <b>10<sup>-6</sup> mb</b>
No. of stages	: Three stages
Material of construction	: Stainless steel 304
Jet	: Stainless steel 304
Pumping fluid charge	: 100 ml
Backing Pump displacement	: 250 lit/min
Warm up time(min)	: 20 mins
Cool down time(min)	: 20
Heater rating	: 500 watts
Operating Voltage	: 230V AC 50 Hz. Single phase



### **LIQUID NITROGEN TRAP:**

A suitable Liquid Nitrogen Trap should be mounted above the Diffusion Pump. It should be essentially a double chamber made of S.S. and inner container contains Liquid Nitrogen. It must have large pumping capacity for water vapor and the condensable. It must require about 5 lit of LN2 for 10 hours' operation.

### **HIGH VACUUM VALVES:**

High Vacuum Valve should be Butterfly Valve which should be able to isolate LNT and DP from vacuum chamber. The valve should be made out of S.S.304 materials.

### **BACKING AND ROUGHING VALVES:**

These valves should be Manually Operated Quarter Swing 1" Butterfly type.

### **COLLAR:**

Collar should be made of S.S 304 and should be mounted above the High Vacuum Valve. It should be a Cylindrical Chamber houses Penning Gauge for vacuum measurement, Air Admittance Valve for Venting, Roughing Vacuum line etc. Top Flange should be fitted to the base plate.

### **VACUUM MEASURING GAUGES:**

One Combined Gauge consisting of two Pirani and one Penning gauge heads should be provided. Three Gauge Heads to read respective vacuum of Roughing, Backing and High Vacuum.

### **Digital Pirani Penning Combined Gauge**

Digital Pirani Penning Gauge Model must be a highly reliable one covering the range of atmosphere to  $10^{-6}$  mbar. It must be supplied with a sensor to monitor the vacuum from  $10^{-3}$  mbar to  $10^{-6}$  mbar. Penning gauge head should be specially designed to avoid frequent contamination. The design of the gauge head should facilitate easy cleaning.

### **Pirani Gauge**

Measuring range	: $1 \times 10^{-3}$ mbr. to 999 mb. (N <sub>2</sub> Equivalent)
Display	: 3 digit for value 1 ½ digit for exponent value 1 digit for channel number
Resolution	: 0.1 of the display value
Response time	: 200 milliseconds
No. of gauge heads	: Two
Recorder output	: 0-10 V DC (All channels)
Operating temp. range	: 10 to 85°C
Bridge voltage	: 2.5 V to 12.5 V approx
Power	: 10W nominals
Main supply	: 230V, 5 Amps, 50 Hz

## **Penning Gauge:**

Measuring range	: $5 \times 10^{-3}$ mbar to $1 \times 10^{-6}$ mbar
Operating voltage	: 2 KV DC
No of gauge head	: One
Construction	: Metal construction
Response time	: 0.5 Sec
Magnet	: Permanent Magnet made out of ferrite magnet
Field Strength	: About 550 Gauss
Material of construction	: Glass to metal seal, S.S. Rod, Aluminum body and ferrite magnet
Coupling	: QF 25 Quick seal coupling
Cable length	: Two meters for each gauge head

## **CHAMBER:**

It should be a D shaped chamber of 300 mm length and height 350 mm fabricated from SS 304 material. The chamber should be mounted vertically and bottom end must be flanged. A rectangular door should be provided in the front which should be hinged/sliding to the main shell. It should be leak tested by Helium Mass Spectrometer Leak Detector to an individual leak rate better than  $1 \times 10^{-8}$  std. cc/sec.

The chamber should be compatible to high vacuum up to  $10^{-6}$  mbar and could be used as standard Thermal Chamber. The chamber should have two numbers of 3" port at right angles and fixed with toughened glass to view inside. The chamber should house LT electrodes for thermal evaporation. Between the LT electrodes either strip filament, coiled filament, basket etc could be fixed depends on the requirement

## **BASE PLATE:**

Base Plate should be mounted above the pumping module made out of SS 304 material. It should house LT/HT Electrodes, Crystal Holder feedthroughs, Ion cleaning electrodes etc. It must have large number of 1" holes and extra holes should be blanked off with SS dummies. There should be a provision for future upgradation of RF sputtering.

## **ION CLEANING:**

Ion cleaning could be used for Glow Discharges cleaning of specimen to give maximum surface cleanliness. An anode ring should be fixed and plasma should strike through this ring and chamber wall by applying high voltage.

## **SUBSTRATE HOLDER:**

A Substrate Holder plate should provided for mounting small samples.

## **SUBSTRATE HEATING:**

The substrates should get heated in the range of up to 500°C. The substrate heater should be connected to the power through step down transformer, SSR relay, Eurotherm make PID controller coupled with 'K' type chromel alumel thermocouple should be provided to measure and control the temperature of the substrate.

**Supporting Frame:**

It should be positioned at a fixed height on trimpot legs to the base plate which could facilitate easy loading.

**H.T.Power Supply:**

It comprises of an H.T. Transformers of 3.5 KV 50m A (5KV open circuit) and with H.T. cables connected to feed through in the base plate. The supply is controlled from the standard HT/LT switch fixed in the front panel.

**L.T.Power Supply:**

It should be derived from LT transformer of having capacity of 10 Volts, at 400 Amps and 20 V, 200 Amps, capable of delivering 360 Amp at 10V and 160 Amps at 20 V for evaporation purpose. The necessary connecting cables should be provided.

**SOURCE SHUTTER:**

Manually operated SS Shutter with necessary seal and operable from outside should be provided. The shutter should be able to get adjusted such that only one source will be exposed and all the other will be covered to avoid cross contamination.

**Electrical:**

Mains Supply	: 230 V AC, 50 Hz
LT Power supply	: An LT transformer capable of delivering 100 amps at 20V or 200 amps operating at 10-V for evaporation purpose
HT Power Supply	: 5000 VDC open circuit used for ion bombardment and DC Sputtering gadget, 3.5 KV at 50 m Amps
LT/HT Control	: An 8 amps Dimerstat in the input circuit of LT/HT selector switch
Meter	: Separate meters for LT voltage & current reading

**DIGITAL THICKNESS MONITOR****Specifications:**

Thickness maximum	: Transducer Limited typically 5000 microgram/sq.cm much as 20,000 microgram/sq for well behaved materials (microgram/Sq.Cm=37Ang.A)
Rate display	: 3 digit LED
Thickness display	: Automatically varied 0.4 to 5 update/sec
Static thickness resolution	: 1 Ang. At minimum update rate
Input parameter	: Tooling factor, density and accoustic impedance inputs allow readout directly in Angstroms
Films No.	: Allows input parameter for 1 to 100 films to be entered
Tooling factor	: 1.0 to 999.9%.
Film accoustic impedance	: 5.000 to 99.99 x 10 <sup>-5</sup> gm/cm. Sec
Shutter control	: Dedicated replay
Thickness set point	: 0.000 to 990.9% K. Ang. Shutter closed when displayed thickness equals or

	exceed set point
Start Control	: Zeros thickness and open shutter
Stop control	: Zeros thickness and open shutter
Shutter position indicator	: LED on indicates shutter relay activated
Crystal compatibility	: 5 or 6 Mhz, jumper, Jumper selectable
Crystal Holder	: Water cooled
Crystal test display	: Type of crystal being used (5 or 6 Mhz)
Crystal Health	: % of crystal life remaining 0% of life referenced to a film thickness of 925 K.A of aluminum
Crystal Frequency	: 5 or 6 Mhz
Output Control	: Rate of thickness select. Full scale and zero scale output useful in calibration recording equipment
Self-test	: Automatic detection and indication of oscillator failure, power line failure, internal failure
Power Requirement	: 230V AC, 50 Hz, 5 Amps

## **SAFETY DEVICES**

- Water flow switches to put off the diffusion pump heater under water supply failure.
- Thermostat switch should be provided to protect diffusion pump from excessive heating.
- DP should be interlocked with Rotary Pump.
- Electrical overload switch.
- Rotary pump, Diffusion Pump etc. should be wired through sensitive circuit breakers.
- Overload protection for Rotary pump meter through current switch should be fixed on the motor.

## **ELECTRICAL WIRING:**

All components should be wired internally with interlocked logics and only a mains power cable with plug is taken out.

## **MATERIALS:**

All the material used for fabrication should be SS 304 material and MS (neatly painted) should be used for support structure.

## **WELDING:**

All weldings should be done by TIG Argon Arc welding by qualified welder following ASME Code Section IX.

## **O’RING:**

All O’rings used should be of viton make only.

**Note: The thermal evaporation system should be compatible and integrated with space provided in the dry box**

## **LEAK TESTING:**

All individual components as well as total system should be leak tested using Helium Mass Spectrometer leak detector to an individual leak rate better than  $1 \times 10^{-9}$  std.cc/sec.

## **ELECTROPOLISHING:**

All SS items should be buffed and electro-polished to bright finish.

## **FABRICATION DRAWING:**

Detailed Fabrication drawings should be prepared and submitted for approval and only after the approval fabrication process should be started.

## **PRE-DESPATCH INSPECTION:**

The instruments should be offered for inspection prior to dispatch and only after clearance from the inspector the unit should be shipped to the site.

## **2. SPECIFICATIONS FOR ULTRASONIC SPRAY PYROLYSIS ACCESSORIES**

### **Ultrasonic Nozzle Features :**

- Ultrasonic nozzle having conical spray pattern which should be capable of covering 50-152mm in diameter, depending on frequency and distance to substrate
- Nozzle should be capable of spraying in a range of ultrasonic frequency from 25 kHz to 180 kHz
- Should have repeatable spray patterns and should be easily shaped
- Ultra-low flow rate capabilities, intermittent or continuous operation
- Highly controllable spray produces reliable, consistent results
- Corrosion-resistant
- Non-clogging
- No moving parts to wear out
- Uniform deposition across entire diameter of spray pattern
- Mean drop diameter should be between 15-18  $\mu$

### **The Ultrasonic Generator Features:**

- Generator should operate over a frequency range of 25 – 180 kHz (frequency should be user selectable through the display for any ultrasonic nozzle).
- Choice of load leveling or power leveling for increased precision and the greatest repeatability of atomization
- Graphic user interface with intuitive wheel encoder should be incorporated enabling full on-screen control of all functions.
- Phase-locked-loop control technology should be available to automatically lock onto a nozzle's optimal operating frequency.
- Should contain inputs and outputs for remote alarm monitoring, external trigger signal and remote power/load leveling control.
- $\pm 4\%$  accuracy should be accomplished for increased repeatability.

### **Coating chamber:**

Should include the following things:

- Compact benchtop XYZ system that favors portability 300 mm x 300 mm x 100mm range of motion, compact, highly functional with integration to nozzle.
- Enclosed Chamber with glass window for sample loading

- Provision for holding a nozzle with XYZ system
- PLC Control Panel
- Heater (Area : 150 mm x 150 mm) with PID controller (Temp 300°C)
- Provision for Exhaust fan
- Syringe pump, Syringe capacity 25ml

**3. COMPUTER CONTROLLED ELECTROCHEMICAL WORKS STATION (SINGLE CHANNEL POTENTIOSTAT GALVANOSTAT WITH 'EIS' SOFTWARE) WITH FOLLOWING SPECIFICATIONS:**

**Standard system specifications:**

- Applied Current limit: 100pA to 400mA or more
- Current resolution : 1000 femto ampere
- Applied voltage range; +/- 9V or more
- Voltage resolution: 5 micro volt
- EIS Freq Range: few uHZ to 6MHz or better
- AC amplitude : 1mV to 2.5 V with the resolution of 5mV
- Modes: Single and multisine should available
- Data acquisition rate: 800000/Second

**Software Requirements:**

- Voltammetry techniques- CV, Multiple CV, SWV, Staircase Voltammetry
- Pulse: DPV, Normal Pulse, RNPV, Chrono amperometry , Chronopotentiometry
- Corrosion: Potentiostatic/Galvanostatic-Galvanodynamic, LPR, Tafel, EIS, CPT
- Energy: charge/discharge Constant potential, constant current, constant power, Constant resistance/load, and Calculation efficiency of cycle.
- EIS: freq sweep – Log / linear, Sweep DC bias with freq. Equivalent and circuit fitting software should be available.
- A complete software package consisting of Battery/Super capacitor/Fuel cell/Photovoltaic/Voltammetry corrosion EIS Software is required.
- Equivalent circuit fitting software is required.

System should be able to control through multiple computers – preferably through Ethernet.  
System should have external devices control / data recording facility –for 10V range

**Accessories required:**

Small volume Electro chemical cell with Teflon cap purge tube , Platinum counter electrode, Platinum working Electrode, Ag/AgCl Reference Electrode Should be provided.  
A compatible Desktop with i-5 Processor, 4GB RAM, 500GB HDD, Windows 8 for instrument control and data acquisition is required.

#### 4. SPIN COATER:

##### **Specifications:**

In the spin coater the angular speed of the substrate, acceleration/deceleration and the coating duration should be set to suit the user requirement using the keyboard and the LCD display in the front panel. The process should be broken into nine steps maximum, each step having different values of speed, acceleration/ deceleration and coating duration

User Interface	: 24 × 4 Line Alpha-numeric LCD and 16 button keyboard
Actuator	: Brushless DC servo motor
Program Memory	: 9 programs with 9 steps for each program
Speed Profile	: Speed, Duration and acceleration
Spin Speed	: 60 – 10,000 rpm
Speed Resolution	: 1 rpm
Speed Accuracy	: +/- 1%
Acceleration/Deceleration	: 10 - 2000 rpm/s (Ramp and dwell times should be set by entering acceleration)
Duration	: 1 - 99 sec/min/hour for each step
Sample Chucks	: 4 Nos. (10 mm, 25 mm, 32 mm & 45mm)
Maximum Sample Diameter	: 100 mm
Minimum Sample Diameter	: 13mm
Bowl Material	: Nylon
Bowl Size	: 8 inches (Lid with transparent window and sample dispensing port and safety interlock to prevent spinning when the bowl is open)
Sample Holder	: PTFE disk with silicon rubber O ring
Sample Mounting	: Secured by vacuum holding
Vacuum Connector	: 8 mm dia Snap-in hose connector
Dimension (mm)	: 400 (L) 275 (W) 350 (H) mm
Power Input (Factory set)	: 230V/110V 50Hz/60Hz
Maximum Power Consumption	: 260W (With vacuum pump)
Drainage hose, Nitrogen/Inert Gas Inlet and Vacuum pump On/off and Release Switches should be provided	

##### **Vacuum Pump Specifications:**

Oil free	
Max flow rate	: 45 litre/min
Max vacuum	: 27 inches Hg
Mac Pressure	: 60 psig
Powder	: 1/4 hp
Dimensions	: 300 x 130 x 200mm

**5. NEWPORT IPCE/EQE MEASUREMENT SYSTEM AND THEIR ACCESSORIES** [for existing New port Solar simulator (Model number: 67005) with Keithley 2400 Sourcemeter in our PI lab at Pondicherry University]

Components for EQE Measurement System for existing New port Solar simulator (Model number: 67005) with Keithley 2400 Sourcemeter in our PI lab at Pondicherry University should essentially consist of the following:

Sl. No.	Item Description	Qty
1	Model 6199, Secondary Focusing Lens Assembly, 6 in. FL, F/4.6, 1.5 Inch Flange	1
2	Model 71260, Filter Holder	1
3	Model 20CGA-305, 305 nm cut-on Filter	1
4	Model 20CGA-570, 570 nm Cut-on filter	1
5	Model CS130-USB-3-FH, Cornerstone 130 1/8m Monochromator, Extended Range, 300-2200 nm, USB Interface, Fixed Slit Holder	1
6	Model 77214, Slits	2
7	Model 74006, Mounting Plate	1
8	Model M-290-4, Platform Assembly	1
9	Model SPX020, Plano-Convex Lens, Fused Silica, 25.4 mm, 88.3 mm EFL, Uncoated	1
10	Model 77330, Focusing Lens Assembly.	1
11	1918-R, Power Meter	1
12	818-UV/DB, Si Detector, 200-1100 nm	1
13	Model 70710QE, Pre-Amplifier For QE System.	1
14	Model :77614, Miniature Vise, Includes 2 Inch Rod	1
15	Model SA2-13, Optical Bread Board, 1x3 feet	1
16	SP-2:Optical Mounting Post, 50.8 mm, 12.7 mm Dia. Stainless Steel, M4 & M6	1
17	Model:BPH-2, Post Holder, Vertical Post Holder, 2 inch adjustable.	2
18	Model: 9743, Rail Carrier	2
19	Model: 9731, Optical Rail	1
20	TA-8Q20-10, Adapter, Thread.	1
21	Model: 90023571, CABLE BNC- M TO MINI-ALLIGATOR 4FT	1
22	Model: 90051899, CABLE, USB2.0, A TO MINI-B, 1M, LF USB 2.0 Cable, Type A Male to Mini B Male,1 m, RoHS.	1
23	Model 70709, Power Supply for 70710QE	1



## TERMS AND CONDITIONS

### I. General Information:

- a) Last date and time of receipt of the Quotations: January 05, 2016, 3.00 PM
- b) Date and Time of Opening of the Quotations: January 05, 2016, 3.30 PM
- d) Quotation / Tender Document fee: Rs. 500/-
- e) EMD rates: 2.5% of the quoted price for each equipment.
- f) **Two bid systems have to be strictly followed.** One for Technical bid and another for commercial bid and each bid should be submitted in separate sealed covers.
- g) However, the tender document fee and EMD as specified above should be remitted by each firm / bidder, collectively for all their bids advertised under this tender.
- h) Quoting merely the lowest price does not confer any right to any bidder for award of supply order. The University's Purchase Committee, reserves the right to select the equipment any bid under the grounds of specification compliance, technologically advanced quality, proven performance track record, brand reputation, service backup support & training, offer of additional / special features, compatibility with the existing System, etc.
- i) The Tender Document Fee and EMD should be submitted in a separate cover superscribing **Bank Demand Draft** and **which should be enclosed with the technical bid.**
- j). The Photo Copies of the Bank Instruments on payment of EMD should be attached with each bidding covers.
- k) The tender / quotation must be submitted along with the stipulated tender document fee and EMD in the sealed cover, super-scribing the name of the Department / Centre for whose equipments the tender is quoted for.
- l) The cover should also contain the information like, Name of the Equipment and Serial Number of Equipments for which the bids are submitted. The name and address of the bidder should also be mentioned at the from address space.
- m). The tenders should be addressed to the Principal Investigator, Pondicherry University.

The examples for super-scribing the envelopes of the different categories of tenders are given below:

Tender submitted under two bid system for the Centre For Nanoscience and Technology  
Name of the Equipment: \_\_\_\_\_

To  
Dr. A. Vadivel Murugan  
Associate Professor,  
Principal Investigator (DST-CERI),  
Centre for Nanoscience and Technology,  
Pondicherry University,  
R.V. Nagar, Kalapet,  
Puducherry – 605014.

From  
Supplier's Address

In case of local delivery, all tenders are to be dropped in the tender box placed at the Information Facilitation Counter, Bharat Ratna Dr. B. R. Ambedkar Administrative Block, Pondicherry University, R.V. Nagar, Kalapet, Puducherry – 605 014.

**n) Quotations will not be accepted through fax / e-mail.**

## **II. Common Conditions (Import or Indigenous)**

### ***1. Purchase of Quotation Document:***

The Quotation / Tender document can be downloaded from the University website **www.pondiuni.edu.in** or procured from the Pondicherry University on payment of fee as specified above, by means of a D.D, drawn in favor of **The Finance Officer, Pondicherry University, payable at Puducherry**. The downloaded application should be accompanied with the quotation document fee, in the form of a Demand Draft.

### ***2. Price Schedule***

The rates should be quoted for a single unit and also for the total quantity required by the University. The price should include the delivery, installation, training charges, etc. at the respective Department, Pondicherry University. The prices quoted shall remain firm until the equipment is supplied to the respective Department, Pondicherry University.

### ***3. Quoting the Core price & Tax, Duties, Discount etc.***

The taxes / duties / discounts, if applicable, are to be explicitly and separately shown in the bid.

#### **4. Eligibility:**

The firm must have the requisite domain expertise with regard to supply, installation and post sale service of the items they are quoting. The firm should have been in existence for at least six years as on the date of this quotation and must have executed at least three orders for this kind of equipment during the last three years. Company should be ISO certified. The firm should have not incurred any loss in the last three years.

#### **5. Installation:**

The engineer should install the equipment **free of cost** at the site. However, utilities like power, water, air etc. will be provided.

#### **6. Delivery:**

Within 3 months from the date of receipt of approved drawings.

#### **5. Duty Exemption**

The University has been granted the benefit of exemption from the payment of the Central Excise Duty and Customs Duty by the Department of Scientific and Industrial Research (DSIR), India, vide their Notification No.10/97 dt. 01-03-1997 and 51/96 dated 23.07.96 respectively, in respect of

- a) Scientific and technical instruments, apparatus, equipment, Software including computers.
  - b) Accessories and spare parts of goods specified in (a) above and consumables.
  - c) Computer software, compact disks, CD ROM, Recording magnetic tapes, microfilms, microchips etc.
  - d) Prototypes.
- Customs duties at Indian port, if any, will be to the account of the University.

#### **6. WARRANTY:**

- i) The equipments covered under the purchase order, when installed, shall be warranted for the quality, workmanship, trouble free operation and performance for a period of at **least 36 months** from the date of putting the system into operation at the Centre for Nanoscience and Technology, Pondicherry University, or at least 42 months from the date of receipt of the last lot of the consignment in India.
- ii) If any item covered under warranty fails, the same shall be replaced free of cost including all the applicable charges including shipping cost both ways.
- iii) Complete technical specifications to be included in the Technical bid.
- iv) The necessary service support should be provided by Bidder during the agreement period.
- v) The training should be provided by the supplying companies for a minimum period of two days from the date of installation with an expert team.
- vi) Technical post sale support by email and telephone will be provided during the period.

- vii) Operating Manual should be provided in English.
- viii) A clear statement regarding availability of after-sales service and availability of spare-parts for next 5 to 10 years should be included.
- ix) A recent customer list (within last five years) with contact details including email address is to be submitted with technical bids / bids as the case may be.
- x) If the equipment is proprietary a product, a proprietary product certificate should be enclosed.
- xi) The information pertaining to infrastructural, power and any other requirement for satisfactory installation and commissioning of the whole system must be provided by the bidder, at least 30 days in advance of the installation to be commenced if purchase order is issued.
- xii) The equipment must operate at 230V/50 Hz single phase and / or equivalent three phase electrical power.
- xiii) If the bidder is an authorized representative in India, they are requested to inform their technical ability to take care of the problems in the system, if developed later within the warranty and outside the warranty period. The responsibility of the Indian agent must be clearly specified.
- xiv) The bidder from abroad shall obtain, if required, export permission from the appropriate authorities in his country or the country of origin for items to be shipped to India in case of items to be imported. The University shall provide necessary information if required for this purpose.
- xv) The validity of the each quotation should be at least for SIX MONTHS from closing date.**
- xvi) The offers will not be considered if received after the bid closing date and time.
- xvii) The offers received through telex / telefax / e-mail will not be accepted by the University under any circumstances.
- xviii) The University shall not be responsible for any delay / loss or non-receipt of quotations by post / courier service.
- xix) No unsolicited correspondence shall be entertained after the submission of the offer.
- xx) If an order is placed with the firm, the purchase shall be governed by an agreement as per the University rules in force at the time.
- xxi) Additional terms and conditions will be incorporated in the purchase order, if needed, to safe guard the interests of the University.
- xxii) Quotation is not transferable.
- xxiii) In case of any dispute in respect of the quotation, all legal matters shall be instituted within the jurisdiction of the place where the purchaser ordinarily resides.

### **7. Power to reject the offer:**

- i) Pondicherry University reserves the right to accept / reject any offer in full or in part or accept any offer other than the lowest offer without assigning any reason thereof. Any offer containing incorrect and incomplete information shall be liable for rejection.
- ii) No Agency commission will be paid to any authorized agent in India.
- iii) Liquidated damages: Timely supply of the ordered items, installation, commissioning (wherever is applicable) and training etc. is the essence of the contract. In case of failure to supply within the time specified in the Purchase order, a penalty / LD of 0.5% of the total value per week or a part thereof shall be levied subject to a maximum of 7.5% in respect of items which are not supplied. The decision of Pondicherry University shall be final in this regard.
- iv) Bidder(s) must be authorized business partners of Global / National service providers of the respective equipment.
- v) The Bidders must enclose authorization letter from the respective global / national service providers of the above equipments particularly mentioning an undertaking that in case of default by the Bidder, they (Global Service Provider) shall take over all the responsibilities of the Bidder.
- vi) The Bidder should not be involved in any Bankruptcy filing for protection from it.
- vii) The training should be provided by the supplying companies on the specimen and operation of the equipments for a minimum period of two weeks from the date of installation with an expert team.
- viii) For any clarification with respect to technical specifications, please contact the PI of the project as per the details given below: -

Sl. No.	Name of the Department/Centre	Name of the PI	Contact Details
01.	Centre for Nanoscience and Technology	Dr. A.Vadivel Murugan Associate Professor & PI	+91 9488566463

### **III. Specific Conditions for Imported Equipments**

#### **1. Payment of EMD:**

The Quotation must be accompanied by EMD as stated above, by means of a Demand Draft, drawn in favor of **The Finance Officer, Pondicherry University, payable at Puducherry**. *The Small Scale units are exempted from payment of EMD provided they enclose the proof of their exemption Certificate issued by the competent authority.*

#### **2. Payments terms:**

- i) Normally a letter of Credit will be opened for 90% of CIP price, on receipt of order acknowledgement. However, 100% of the LC also be considered, if the supplier provide Bank Guarantee towards performance Security for the 10 % of the total cost of the equipment to cover the Warranty Period.

- ii) Bank charges in India shall be borne by the purchaser and outside India shall be borne by the contractor / supplier.
- iii) The offer must be in English. The rates should be indicated both in figures and words against item specified in the given table. It is preferable that the price be quoted in Rupees or in US Dollars or in major foreign currencies.
- iv) The total cost should be quoted for FOB as well as CIF – Pondicherry University.
- v) However, the price quoted under FOB or should also include the following cost if they are required during the initial stage:
  - a) Local freight / insurance for Chennai airport to University laboratory.
  - b) Installation cost if any.
  - c) Cost of consumables which are required for the equipment for initial operation upto a reasonable time.
- vi) In case of the Principal supplier of Foreign country unable to meet the conditions stated at para no.4, the local agent / dealer should fulfill the above said conditions in respect of Local Insurance, Freight, safety transport and installation, etc.
- vii) The bidder from within India shall obtain the requisite approval for Imports etc., if required.

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