SPECTRO ELECTROCHEMISTRY UNIT

A Spectro-Electrochemical Workstation is required with potentiostat/galvanostat with below specifications.

Note: Vendor should be an authorized provider of sophisticated high-precision potentiostat/galvanostat systems for past 15 Years or more with a

- A proven track record in multiple countries and national institutes
- Standard quality certifications such (ISO 9001)
- 5+ past installations of similar systems in India in past three years. At least 5 POs of recent installations to be provided along with customer details.

Electrochemical Workstation Channels:

- Compliance voltage: ± 18 V or better at ± 350 mA current in complete range – Adjustable compliance voltage configurations will not be considered
- Maximum Output Current: ± 350 mA or better at ± 18 V
- Output Voltage Range: ± 10 V or better
- Current Ranges: ± 10 nA to current range ± 100 mA in nine ranges
- Measured current accuracy: 0.0003% at entire current range (30 fA at 10 nA range). Must be a default hardware configuration without any additional external accessories or current boosters
- Measured Potential Resolution: 5 µV or better
- Potentiostat Rise/fall Time: < 300 ns or lower
- Interface: USB interface for connection with PC or better
- Input bias current: < 1 pA
- Bandwidth of electrometer: > 4 MHz
- Input impedance of electrometer: > 100 GOhm // 8 pF

<u>Advanced Spectro-electrochemistry Set-up- Qt. 1</u>

A fully integrated & synchronized 'complete solution' spectro-electrochemical system that can be used independently as a Spectrometer or as a Potentiostat/Galvanostat. Complete spectro-electrochemistry setup should be supplied by single OEM and should be operated by single software. The package should include all cables, cell set-up, electrodes and accessories for fully integrated one click spectro-electrochemistry data generation using single software.

A spectrophotometer kit with UA grating that has following specifications:
Detector: CCD linear array
Pixels: 2048 or better
Fiber optic connector: SMA
Wavelength range: 200-1100 nm
Signal to noise ratio: 300:1 (at full signal)
A/D resolution: 16 Bit, 2 MHz
Dark noise: 20 counts RMS
Integration time: 1.11 mS - 10 minutes
Stray light: 0.04-0.1%, depending on the grating

Light source required:
Wavelength range: 200-400 nm (deuterium), 400-2500 nm (halogen)
Stability: < 1 mAU (Deuterium) < 1 mAU (Halogen)
Time to stable output: 8 min (Deuterium), 1 min (Halogen)

Bulb life: Minimum 2000 hours
Fiber optic connector: SMA

A sophisticated spectro-electrochemical software control required:

- Shutter lamp control: Automatic dark and reference
- Real Time panel that collects the generated spectra not only during the electrochemical measurement but continuously at any time.
- **Spectroscopic measurements shown in Counts, Absorbance, Transmittance or Reflectance during the electrochemical process.**
- Plot of Optical Spectra vs. Electrochemical Curves at a specified wavelength
- Plot overlay, peak integration, smoothing, subtraction, derivative curve, baseline fitting.
- 3D plotting of curves & export .csv of overlayed plots

Electrochemical Software for Spectro-Electrochemistry Set-up

The Software to be provided with the Potentiostat / Galvanostat should be comprehensive, fully windows based with three-dimensional view of graphics and analysis software. Software should record current, voltage and time for cyclic and linear sweep voltammetry measurement. It should be possible to record current, voltage and time data in tabular format for each measuring point in voltammogram. Software should be capable of supporting a wide variety of electrochemical techniques as mentioned below.

- Cyclic & Linear Sweep Voltammetry
- Linear Polarization
- Differential Pulse, Sampled DC & Square Wave Voltammetry
- Chrono-amperometry, chrono-coulometry and chrono-potentiometry ($\Delta t >$ 1 ms)
- It should have facility to display up to 10 or more plots simultaneously
- Tutorials to help the user to familiarize with software
- Sequential programming of different electrochemical methods and optional accessories
- Comprehensive database structure & powerful data analysis tool.
- Inbuilt electrochemical spread sheet
- User programmable formulae to new plots.
- Powerful graphic engine with useful features such as individual Axis scaling, overlays, multiple Y axes, plot addition, zooming and rotation.
- Each plot should be saved as a vector image file to use directly in paper or presentation
- Software should have facility to record additional signal viz EQCM, bi-potentiostat etc.
- Import/export ASCII, Ready-to-use Vis & Generic interface for .Net applications should be included.

EIS Option for future expandability

Hardware and software for EIS measurements should be available in potentiostatic and galvanostatic control, over frequency range of 10 µHz to 1 MHz. It should be possible to perform EIS measurements over entire frequency range from 10 µHz to 1 MHz upto ± 350 mA currents. The frequency range in combination with a commonly available external waveform generator should be 10 µHz - 32 MHz. The frequency range in combination with potentiostat / galvanostat should be 10 µHz - 1 MHz. The applied frequency resolution should be 0.003% or better.

Measured EIS Data presentation:

Real-time fit and simulation analysis as well as 'live' data plotting option for the simulation plot must be available as default software protocol. Also real-time measurement plots needed for – Lissajous curve, Nyquist, Bode, Admittance, Dielectric & Mott-Schottky. The fit and simulation software should include

basic options such as find circle, element subtraction and an equivalent circuit library with all the modern EIS equivalent circuit models (Randle's, transmission line, etc.). Minimum visible plots in real time should be 8 or more.

High Current Booster Option for future upgrade

Anytime current amplification option is required for future expansion as and when required. **The booster should not use any additional slots**. The current booster option is required to boost the measurement as well as applied current capability of the channel up to ± 10 A. A compliance voltage of ± 20 V or better with booster is preferred. Measurement current accuracy of 0.0003% with booster is highly required for accurate high precision measurements as well as optimizing parameters for electrodeposition research.

Expandability options for following:

- Electrochemical Impedance Measurements
- Electrochemical Quartz Crystal Microbalance Analysis
- Multiplexing options to conduct experiments up to 64 independent cells
- Bi-potentiostat options from desired channel
- Simultaneous temperature or pH measurements
- Single channel AC or DC light intensity control for LED Optical Bench without using an additional channel
- External Triggering: ADC, DAC, TTL

The systems should be compatible with following for future upgradation using 'single software' application:

a) Rotating Ring Disc Electrode
b) Electrochemical Surface Plasmon Resonance
c) LED optical bench – Photo Modulated Electrochemistry
d) Scanning Electrochemical Microscope - SECM
e) Spectro-electrochemistry with 'Single Software' mechanism

Warranty: **Minimum 3 years**

A detailed compliance certificate against each specification needs to be provided by the vendor along with the technical brochure

Service facility and down-time call attendance:

Supplier should clearly mention about their service set up in India (preferably in South part of India) for prompt service support along with contact details of service engineers specially trained on the offered system. Service should be provided within 24 h from the report of technical problem so that machine down time is minimized.

In case the Equipment / System remains non-operational for more than 5 days then warranty period will be extended for the equivalent period for which Equipment / System remained non-operational. Warranty extension in such case shall be done without prejudice to any other Term & condition of the contract.

Installation and training at the customer site is required.