

# **REVISED SPECIFICATIONS AS ON 27 DECEMBER 2023**

## **Electrochemical Workstation/integrated Bi-Potentiostat System with EIS and RDE/RRDE system Specifications**

### **Integrated Bi- Potentiostat Electrochemical system Specifications:**

#### **General Techniques**

- Cyclic Voltammetry (CV)
- Linear Sweep Voltammetry (LSV) with stripping
- Bulk Electrolysis with Coulometry (BE)

#### **Trace Metal analysis & Pulse Techniques**

- Differential Pulse Voltammetry (DPV) with stripping
- Normal Pulse Voltammetry (NPV) with stripping
- Square Wave-Osteryoung Voltammetry with stripping

#### **Corrosion**

- Tafel Plot (TAFEL), potentiodynamic deactivation, pitting corrosion, corrosion rate, linear Polarization, Corrosion current etc.

#### **Fuel cell**

- Multi-Potential Steps
- Multi-Current Steps
- Chronopotentiometry
- Polarisation I-V curves Linear Sweep
- Open Circuit Potential – Time (OCPT)

#### **Impedance**

- AC Impedance (IMP)
- Mott-Schottky
- Impedance – Potential (IMPE)
- Impedance Simulator with fitting
- Open Circuit Potential – Time (OCPT)

#### **Battery Charge/Discharge**

- Galvanostatic Charge discharge single/multiple cycle -Chrono Potentiometry (CP) with potential limits, polarity by potential or time, no. of cycles etc

#### **Deposition Studies**

- Single or Multi potential steps with charge limits, single or multi current steps, mixed voltage/current control using advanced programming.

#### **General Useful Techniques**

- Chrono Amperometry (CA)
- AC Voltammetry (ACV) with stripping with an external / internal signal generator.
- Hydrodynamic Modulation Voltammetry
- Chronopotentiometry with Current Ramp
- RDE control (0-10V output)
- IR Compensation
- External Potential Input

#### **Hardware Specification:**

- Integrated Bi-Potentiostat / Galvanostat: 2- or 3- 4 electrode configuration
- Maximum potential:  $\pm 15V$  Maximum current: 1Amp
- Compliance Voltage:  $> \pm 17V$
- Potentiostat rise time:  $0.8\mu s$  typical
- Measured current range:  $\pm 20pA$  to  $\pm 1A$  in 8 ranges or above.
- Measured current resolution: 0.003% of the current range
- Applied current accuracy:  $\pm 0.2\%$  of setting,  $\pm 0.05\%$  of range
- Input bias current:  $< 20 pA$ ,
- CV and LSV scan rate:  $10 \mu V/s$  -  $75 V/s$  two channels simultaneously.
- Potential Increment during scan:  $\leq 0.1mV$
- CA and CC pulse width: 0.00016 - 1000 sec
- CA and CC minimum sample interval:  $\leq 80 \mu s$

- DPV and NPV pulse width: 0.001 to 10 Sec
- i-t sample interval: minimum 80  $\mu$ s, both channels
- IMP frequency: 10 $\mu$ Hz to 1MHz
- IMP amplitude: 1 mV – 200 mV peak
- Fast data acquisition: dual channel 16-bit ADC,  $\geq$  125000 samples/sec simultaneously
- Automatic and manual iR compensation
- USB port for data communication

#### **Software Features: Windows based software for data processing.**

- a) Graphic Display
- b) Present data plot, overlay plots: several sets of data overlaid for comparison, add data to overlay, adding data files to overlay plot etc.
- c) Should provide Single window experiment control, data organizing and analysis (including EIS circuit fitting) software.
- d) Should be Free upgradation for a lifetime.

#### **RDE / Rotating ring disk electrode system**

Required specifications are as follows:

- System should be of compact design and easy to operate
- It should have provision for conducting electrochemical experiments both in RDE and RRDE mode
- Remote and Manual controlled rotation should be possible
- It should allow remote control from the PC (rotational speed ON/OFF)
- Rotational speed range 10-8000 rpm,
- Speed should be displayed in a display unit
- Start/Stop (external): should have provision for digital motor stop input signal on external I/O port as optional. Available TTL logic: active high or active low, jumper selectable. The front panel LED should indicate when external motor stop is active.
- Enclosure Interlock: should be capable of preventing rotation when enclosure window is in raised position. Front panel LED should indicate enclosure interlock state.

#### **Specifications**

Rotational range: 10 to 8,000 rpm

Rotator shaft: The rotating shaft should be fabricated from PEEK and stainless steel.

Operating temperature: 10 to 50 deg C

Relative humidity:  $\leq$  80%

Motor Power: 11 W

Motor Type: Permanent magnet

Max. Continuous Torque: 18.7 milliNewton-meters

Motor Protection: Motor current should be electronically limited.

**RDE/RRDE shaft:** The rotating shaft should be fabricated from PEEK and stainless steel. It should be compatible with Fixed/Change Disk RDE/RRDE Tip of 5.0 mm disk OD, 15.0 mm OD PTFE shroud.

The shaft should also be compatible with High Collection Efficiency (43.9%) RRDE Tip. Should have provision for using gas-purged bearing assembly for the shaft.

**Electrode connections Brush:** Electrode connections to the rotating shaft should be made using silver-carbon brushes.

OEM for electrode rotator and RDE/RRDE tip must be same.

#### **Accessories for RDE/RRDE system**

- a) **RDE/RRDE Cell with Water Jacket:** Should be 150ml volume with 4 $\times$ 14/20 ports and 1 $\times$ 24/25 central port including PTFE Stopper for each port. Dual Port Gas Inlet and Single Port Gas Outlet Accessories can mount in any 14/20 side port.
- b) **Glassy Carbon Disk, Platinum Ring Fixed Disk RRDE Tip:** Disk OD = 5.5 mm, Ring OD = 8.5 mm, Ring ID = 6.5 mm, PTFE ring-disk separator, 15.0 mm OD PEEK shroud should be provided.
- c) **Standard Platinum Counter Electrode Kit:** Should include isolation tube and adapter to fit 14/20 port with, Pt Wire OD: 0.5 mm, Pt Wire Approximate Surface Area: 4.7 cm<sup>2</sup> and Epoxy Shroud Dimensions: 6.9 mm OD x 150 mm Long.
- d) **Single Junction Silver Chloride (Ag/AgCl) Reference Electrode:** Standard Potential: 0.199 V vs. NHE, Filling Solution: 4 M KCl with AgCl. Should include 14/20 PTFE adapter and storage bottle of filling solution.
- e) **Hg/HgO Reference electrode**

**f) Polishing Kit:** This kit should include, 2 polishing bases, 6 artificial fleece polishing cloths, 5 polishing cloths, 5 sheets of 2000# sandpaper, 5 sheets of 3000# sandpaper, 20 grams of 1.5um polishing powder, 20 grams of 0.5um polishing powder, 20 grams of 0.05um polishing powder.

**Warranty: 1 Year warranty**

**Computer:** Desktop/Laptop Computer i5 Processor, 8GB DDR4 RAM, 512 GB-SSD/1 TB HDD

**Training:** Training should be provided to the students & staff who will be operating the system.