Ref. No.: IISc/CE/Tender/2024/Domestic/MEWS1 Date: 14 June 2024

Tender Notice for Procurement of Multichannel Electrochemical Workstation for General Electrochemistry, Tribo-Corrosion, Battery, Supercapacitor, Elecrocatalysis, Chemocatalysis, Energy Applications etc.

(Last Date for Submission: 5 pm on 05th July 2024)

(TENDER FROM DOMESTIC VENDORS)

Date: 14 June 2024

Dear Sir/Madam,

This is a Request for Quote (RFQ) from Class -1 and Class -2 local suppliers/manufacturers only for the procurement of a Multichannel Electrochemical Workstation for general electrochemistry, battery and supercapacitors, for the Department of Chemical Engineering at the Indian Institute of Science (IISc), Bangalore.

Only the Indian Original Equipment Manufacturer (OEM) or their distributor shall submit a response demonstrating their capabilities to produce the requested equipment to the primary point of contact listed below. The quotations should be on FOR-IISc Bangalore basis in INR only.

With respect to this tender, the rules laid out by the Government of India in order No. P45021/2/2017- pp-BE-II issued by the Public Procurement Section, Department or Promotion of Industry and Internal Trade, Ministry of Commerce, and Industry, dated 4th June 2020 will be followed. The bidders must go through the Government of India order stated above and follow all the rules and regulations therein. Relevant definitions as per Government of India order:

Class-1 local supplier - A supplier or service provider, whose goods, services or works offered for procurement, has local content equal to or more than 50%.
Class-2 local supplier - A supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%.

Bidders offering imported products will fall under the category of non-local suppliers. They cannot claim themselves as Class-1 local suppliers/Class-2 local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training, and other sales service support like AMC/CMC, etc., as local value addition.

Purchase preference as defined by the recent edits to GFR (within the "margin of purchase preference") will be given to the Class-1 supplier.

MSMEs can seek an exemption to some qualification criteria. IISc follows GFR2017 for such details.

The tender should be submitted in two separate sealed envelopes: one containing the technical bid and the other containing the commercial bid, both of which should reach us, duly signed on or before 05th July 2024, 5PM. The bids should be addressed to:

The Chairman,
Department of Chemical Engineering
Indian Institute of Science
Bangalore 560012, India.
Kind attention: Dr Sanjeev Kumar Gupta, Chemical Engineering
Email: chair.ce@iisc.ac.in, sanjeev@iisc.ac.in

Configuration Design: Bi-Potentiostat /Multichannel Electrochemical Workstation
Multi-channel electrochemical workstation with minimum of 17 channels (Electrochemical cells, battery materials, electrochemical sensors, catalysts, other allied materials & systems)

Area of Application	
1.	Two electrodes as well as Three Electrode Tests should be possible with provision to connect Independent Reference Electrodes for all Channels independently and simultaneously.
	Bi-potentiostat facility should be available for RRDE experiments.
	Provisions to connect 2 Working electrodes and provisions to measure EW1 and EW2 simultaneously in one Cell Setup with common Reference and common Counter Electrodes.
	General Electrochemistry, Tribo-Corrosion, Battery, Supercapacitor, Elecro catalysis, Chemocatalysis, Energy Applications etc..,
General Description	
2.	Five channels Galvanostatic & Potentiosatatic voltametric studies, EIS, Pulsed Techniques capability and Separate programming feature.
3.	Twelve or more channels with cell charge discharge cycling capability, programming, results summary and data analysis facility
4.	Provision for augmenting additional channels shall be available in the same chassis/enclosure to cater to future expansion need.
5.	**Specifications for Channel Numbers from 01 to 04**
	➢ Maximum Current: ± 1 A or more ➢ Expandable upto 750A with Booster ➢ Multichannel Chassis ➢ Channels required: 4 Channels ➢ Channels Required with EIS: 04 channels. ➢ Cell Cable 1.5 M long with Electrode Connection: 2, 3, 4 , 5 electrode leads + ground or more ➢ Electrode cables required: 04 ➢ Compliance voltage: ±0-20 V or better ➢ Applied Voltage: ±10 V or better. ➢ Maximum Output Current: ± 1000mA at ± 10 V or better ➢ Current Ranges: ± 10 µA to 1000mA or better ➢ Current resolution: 0.760 nA ➢ Stability control mode (7 bandwidths)

	➢ Accuracy of applied and measured current: ± 0.1 % of Full-scale range or better for all available channels. ➢ Voltage accuracy applied and measured: 0.1% of Full scan range or better. ➢ Potentiostat Rise/fall Time: < 2µs or better ➢ Electrochemical Impedance Spectroscopy: 1 Nos. ➢ Frequency range: 10µHz to 1MHz or better ➢ Impedance accuracy of 1%, 1° ➢ Input Impedance: 1TΩ or better ➢ Bandwidth of electrometer with Booster: >1 MHz or better ➢ Input bias current: <5pA or better ➢ Acquisition: 200,000 samples/second or better ➢ Min acquisition time should be around 20-30 µs or better for all channels, suitable fast acquisition modules can be quoted as standard. ➢ Interface for connection with PC: USB, Ethernet LAN
	➢ Local Area Network to remote access to the instrument ➢ Safety limits in software on the current and voltage Max and Min values to avoid hazards.
6.	**Specifications for Channel Numbers from 05 to 16**
	➢ Maximum Current: ± 1 A or more ➢ Expandable upto 750A with Booster ➢ Multichannel Chassis ➢ Channels required: 12 Channels ➢ Channels Required without EIS: 12 channels. ➢ Cell Cable 1.5 M long with Electrode Connection: 2, 3, 4 , 5 electrode leads + ground or more ➢ Electrode cables required: 04 ➢ Compliance voltage: ±0-20 V or better ➢ Applied Voltage: ±10 V or better. ➢ Maximum Output Current: ± 1000mA at ± 10 V or better ➢ Current Ranges: ± 10 µA to 1000mA or better ➢ Current resolution: 0.760 nA ➢ Stability control mode (7 bandwidths) ➢ Accuracy of applied and measured current: ± 0.1 % of Full-scale range or better for all available channels. ➢ Voltage accuracy applied and measured: 0.1% of Full scan range or better. ➢ Potentiostat Rise/fall Time: < 2µs or better ➢ Electrochemical Impedance Spectroscopy: 1 Nos. ➢ Frequency range: 10µHz to 1MHz or better ➢ Impedance accuracy of 1%, 1° ➢ Input Impedance: 1TΩ or better ➢ Bandwidth of electrometer with Booster: >1 MHz or better ➢ Input bias current: <5pA or better ➢ Acquisition: 200,000 samples/second or better ➢ Min acquisition time should be around 20-30 µs or better for all channels, suitable fast acquisition modules can be quoted as standard. ➢ Interface for connection with PC: USB, Ethernet LAN ➢ Local Area Network to remote access to the instrument

	➢ Safety limits in software on the current and voltage Max and Min values to avoid hazards.
7.	**Items to be quoted in Optional** • 10A Booster: 01 Nos • Booster Chassis: 01
8.	**Specifications for Channel Numbers 17**
	➢ Cell Connection: 2, 3, 4, 5 electrodes (+ ground) or more and atleast1.5m Cell cable ➢ Capacity to hold up to 02 channels in a single chassis or more ➢ Required no Channel with EIS: 01 Nos ➢ Compliance voltage: +/-12 V or better ➢ Applied Voltage: ±10 V or better ➢ Maximum Output Current: ± 500 mA or better at ± 10 V ➢ Current Ranges: ± 10 nA to ± 500 mA or better ➢ Accuracy of applied and measured current: ± 0.1 % Full scale range or better ➢ Resolution of applied potential: 1µV or better ➢ Voltage accuracy: 0.1 % of Full scale range or better ➢ Measured current resolution: 800 fA on lowest current range ➢ Potentiostat Rise/fall Time: <500nS or better ➢ Impedance Frequency range: 10µHz to 6 MHz or better ➢ Impedance accuracy of 1% & 1° at 1Hz ➢ Input Impedance: 1TΩ or better

	➢ Gain bandwidth range of amplifier: 1 MHz or better ➢ Bandwidth of electrometer: 1 MHz or better ➢ Input bias current: 20pA or better ➢ Cyclic Voltammetry with scan rates 10 mV/Sec to 100V/Sec or better ➢ Ac Amplitude: 0.5mV – 2.5 V ➢ Floating mode Floating mode should be available ➢ Interface for connection with PC: Ethernet LAN ➢ Local Area Network to access Multiple Computers
9.	**Specifications for Channel Numbers 18**
	➢ Cell Connection: 2, 3, 4, 5 electrodes (+ ground) or more and at least 1.5m Cell cable ➢ No EIS measurement ➢ Compliance voltage: +/-12 V or better ➢ Applied Voltage: ±10 V or better ➢ Maximum Output Current: ± 500 mA or better at ± 10 V ➢ Current Ranges: ± 10 nA to ± 500 mA or better ➢ Accuracy of applied and measured current: ± 0.1 % Full scale range or better ➢ Resolution of applied potential: 1µV or better ➢ Voltage accuracy: 0.1 % of Full scale range or better ➢ Measured current resolution: 800 fA on lowest current range ➢ Potentiostat Rise/fall Time: <500nS or better Input Impedance: 1TΩ or better
	➢ Gain bandwidth range of amplifier: 1 MHz or better

		➢ Bandwidth of electrometer: 1 MHz or better ➢ Input bias current: 20pA or better ➢ Cyclic Voltammetry with scan rates 10 mV/Sec to 100V/Sec or better ➢ Ac Amplitude: 0.5mV – 2.5 V ➢ Floating mode Floating mode should be available ➢ Interface for connection with PC: Ethernet LAN ➢ Local Area Network to access Multiple Computers
10.	**Quoted Instrument should be ready for Further upgradation to the following,** • Spectro Electrochemistry setup • Photo Electrochemistry setup • RDE & RRDE • OER & HER • Electrolysers • In situ Applications like Raman, XRD • Etc..,	

Complete software with following specification

11.	➢ Should have possibility to resume an experiment after a power cut and to merge the files before and after the power cut. ➢ Possibility to Record/Measure and control Ewe (potential difference between Working and reference) and Ece (potential difference between Counter and Reference) simultaneously in one experiment and in real time ➢ On site calibration of the channel should be available ➢ Complete battery and supercapacitor cycling software facility with following options: ➢ Galvanostatic Charge / Discharge (Including C rate control) with voltage vs. time ➢ Graph plots ➢ Multigraph window capable of displaying up to 50 graphs within a single window ➢ Customize variables graph plot for each axis ➢ Voltage vs. Capacity plot during Charge/Discharge Cycles ➢ Atleast 3 limits and 3 recording conditions per sequence/cycle (ability to limit a cycle or changeover to next sequence with Time, Voltage/Current, Charge/Power all simultaneously) ➢ Multiple recording conditions with "OR" commands ➢ Industrial CC-CV Method (Constant Current – Constant Voltage) ➢ Cyclic Voltammetry, Current Scan (Current/Galvano Dynamic), Voltage Scan (Potentio Dynamic) ➢ Constant Power / Constant Resistance ➢ GITT and PITT Techniques Battery Characterization -Polarization Curve measurement/IV Testing/ Linear ➢ Sweep Voltammetry should be available down to 0 Volt.OCV/OCP, Cyclic Voltammetry, Chrono Amperometry, Chrono Potentiometry, ➢ Staircase Voltammetry, Corrosion – Linear and Cyclic Polarization, Pitting ➢ Corrosion, ZRA ➢ Columbic Efficiency Determination with fitting tool

	- Current Interrupt - Rest Time - Multiple loops - Provision to connect and control External devices like Furnace, Thermal chambers - Monitoring status of each Channel using Global Table/Summary Table - Option to update the experimental setting parameters on current running experiment without pausing /stopping the channel/experiment

	- Profile Importation to study Urban Life Cycle Tests - Analysis tools like Integral, Circular or linear fit and Electro chemical EIS -Z fit should be available - **Experimental Technique**s like All Voltamperometric techniques including Levich Plot:Levitch - **All Voltamperometric techniques Like:** OCV, CV, CVA, LSV, CA/CC, CP, SV, ACV, Levitch. - **Impedance Spectroscopy:** GEIS, PEIS, SGEIS, SPEIS - **Pulsed techniques:** DPV, SWV, NPV, RNPV, DNPV, DPA - **Manual Control:** Current Manual Control, Potential Manual Control - **Ohmic Drop determination:** Manual IR compensation, IR Compensation (PEIS), Current Interrupt - **Batteries testing:** BCD, CCCV, GCPL, GCPL1 to 7, MB, CED, CLD, CPW, APGC, PPI, GPI, RPI, PWPI, CV - **Bipotentiostat techniques:** CV-CA, CP-CA, CA-CA - **Corrosion:** Ecorr versus Time, Linear Polarization Resistance – LPR, Tafel Plot, Cyclic Polarization, Cyclic, Potentiodynamic Polarization – Critical Pitting Temperature-CPT, Depassivation Potential, Potentiodynamic Pitting, Potentiostatic Pitting, Electrochemical Noise, Biased Electrochemical Noise - **Photovoltaics/Fuel cells:** I-VC, CLD, CPW, CstC, CstV - **Supercapacitors:** CV, CstV, CstC, CS - **Other Applications:** Polarization Resistance, Stepwise Potential Fast Chronoamperometry, Anodic Stripping Voltammetry, RRDE - **User Building Techniques:** Modular Potentio, Modular Galvano, Trigger In/ Out, Temperature Control, RRDE Control, External Device Control, Loop, Pause - Reverse Normal Pulse Voltammetry: RNPV - Differential Normal Pulse Voltammetry: DNPV - Differential Pulse Amperometry: DPA - Ohmic Drop determination - Potentiodynamic Cycling with Galvanostatic Acceleration: PCGA, Modulo Bat: MB - Polarization Resistance: PR - Stepwise Potential Fast Chronoamperometry: SPFC
Electrochemical Impedance Spectroscopy (EIS)	

12.	➢ Real-time fit and simulation analysis as well as live data plotting option for simulation plot must be available as default software protocol. Real time needed for Lissajous curve, Nyquist, Bode, Admittance and 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. Minimum visible plots in real time should be 8 or more. EIS Modelling with Equivalent Circuit Fits. Simultaneous impedance measurement at counter electrode and working electrode.
	➢ EIS Quality Indicators should be provided
	➢ EIS measurements simultaneously on the working and on the counter electrodes
	➢ Graphic Representation of Equivalent Circuit with user selectable circuit elements and their values in the circuit
	➢ Impedance fitting tool with battery diffusion elements available (restricted diffusion, restricted modified diffusion, restricted linear diffusion)
	➢ The impedance fitting tool should have at least 3 different fitting algorithms
	➢ Modify on Fly should be available to update experimental setting parameters on current running experiment without pausing/stopping.

Accessories

13.	➢ Glass Cell 50-60ml: 04 Nos
	➢ Cell Cap: 02 Nos
	➢ Purge Tube
	➢ Ag/AgCl Reference Electrode: 01 No
	➢ Platinum counter electrode (5 cm - wire diameter 0.5 mm):01 No
	➢ GCE Glassy carbon electrode (OD: 6 mm – ID: 3.0 mm):01 No

RRDE Setup

14.	➢ RRDE kit: controller and Rotating Ring Disk Electrode (motor + shaft), comes with shipping
	➢ RRDE enclosure and cell stand
	➢ 1 mm Pt Ring 3 mm GC disk electrode (M6 thread) with PEEK body
	➢ 3 mm diameter Glassy Carbon disk electrode (M6 thread) with PEEK body

Installation & Commissioning

| 15. | ➢ Installation and commissioning of the equipment has to be carried out by supplier at our laboratory in IIST and the performance has to be demonstrated. |
| | ➢ 2. Onsite training must be provided to our personnel on the installed equipment for operation and data processing |

Instrument Control

| 16. | A Desktop Computer i7 with 500 SSD, 20/21" Color monitor, Windows OS, Wired Keyboard and Mouse shall be provided or with better Configuration. |

Warranty

| 17. | System shall be warranted for a minimum period of 1 year from the date of installation of the equipment at site |

AMC

18.	Separate quote for AMC for Three years after the warranty period shall be submitted with offer. AMC cost will be considered for grading the vendor, along with equipment cost. Quote for both comprehensive and non-comprehensive AMC shall be submitted. Number of visits per year: One preventive & One breakout visit.
Maintenance	
19.	The channels Should be plug & play type and easy to install or to be removed.