

**Tender Notification for the Procurement of a Porosimeter / BET Surface Area Analyzer Instrument (Last Date for Submission: Monday, February 15<sup>th</sup>, 2021)**

Best quotations are invited for the procurement of a **Porosimeter / BET surface area analyzer** instrument equipped with both the gas and vapour adsorption facility with the following technical specifications on C.I.P. Bangalore basis (by **Air Freight** only) from domestic vendors only. Your quotation should mention the terms of delivery, delivery schedule, estimated delivery date, and payment terms. 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 17:00 hours on 15<sup>th</sup> February 2021, Monday.

The bids should be addressed to:

**The Chairman,**  
Solid State and Structural Chemistry Unit  
Indian Institute of Science (IISc)  
Bengaluru, India - 560012.

The sealed bids should be sent to:

**Dr. Abhishake Mondal**  
Solid State and Structural Chemistry Unit  
Indian Institute of Science (IISc)  
Bengaluru, India - 560012.  
Ph: +91-9932207177  
email: [mondal@iisc.ac.in](mailto:mondal@iisc.ac.in), [chair.sscu@iisc.ac.in](mailto:chair.sscu@iisc.ac.in)

Please enclose a compliance statement along with the technical bid.

# Technical Specifications for Physical Property Measurement System

## 1. Broad System Requirements and Usage

We are seeking to procure a state-of-the-art Porosimeter / Brunauer-Emmett-Teller (BET) surface area analyzer to be part of the departmental characterization facility. Therefore, the following technical criteria are to be met by any Porosimeter / BET instrument being quoted under this tender notice:

- 1.1. Access of the instrument being quoted should be automatic multi-user friendly with an easy-to-use software interface, modular hardware design that allows for rapid user training. It should also be easy to change from one measurement mode to another with relative ease so that our students can set-up measurements, collect the reliable and reproducible experimental data, and analyze.
- 1.2. Our faculty members are working in diverse areas of research at the intersection of fundamental chemistry, physics, and new materials synthesis and characterization. Therefore, the Porosimeter / BET being quoted should be an advanced and updated version that can go far beyond the basic physical property measurements with the highest level of accuracy. For example, the instrument should have the ability to measure both the gas as well as vapour adsorption with high precision.
- 1.3. In addition, the system being quoted should have a modular design providing the flexibility to add any of the above capabilities or other physical property measurement techniques either at the time of procurement or at a later date.

## 2. Porosimeter/BET Base System Requirements

### 2.1. Measurement Type

- 2.1.1. The system being quoted should have the ability to measure adsorption, desorption isotherms, BET and Langmuir Surface Area, BJH method, t-plot, MP method, Dubnin Ashtakov method with the highest level of accuracy.
- 2.1.2. The instrument being quoted should have the ability to measure both the gas (*e.g.* H<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, Ar, Kr, CO<sub>2</sub>, CO, CH<sub>4</sub>, NH<sub>3</sub>, *etc.*) as well as vapour (*e.g.* H<sub>2</sub>O, MeOH, EtOH, C<sub>6</sub>H<sub>6</sub>, *etc.*) adsorption with high precision under variable temperature.
- 2.1.3. The instrument being quoted should have a broad range of adsorption measurement pressure (*e.g.*  $P/P_0=10^{-9}$  - 1) so that we can get data at extremely low pressure as well. The system shall have 1000 Torr, 10 Torr, 0.1 Torr transducers to measure surface area, and porosity for a wide range of materials.
- 2.1.4. The instrument being quoted should have the ability to measure specific surface area range 0.01 m<sup>2</sup>/g or more (N<sub>2</sub>, 77K) and 0.0005 m<sup>2</sup>/g or more (Kr, 77K).
- 2.1.5. The system being quoted should have the capability to measure and analyze the pore size minimum of 3.5 Å or better range (0.35 - 500 nm).
- 2.1.6. The system being quoted should have a broad range of measurement temperatures (-100 to ≥ 400/500 °C).

2.1.7. The instrument being quoted should have the ability provision to correct the dead volume Change without any need to maintain the liquid nitrogen level.

## 2.2. Number of Sample Analysis Port

2.2.1. The instrument being quoted should have multiple sample analysis facility at a time ( $\geq 4$  samples) with an expandable sample port up to 10 or more. The individual ports their own dedicated transducer must not share with other ports for accurate measurement of each port.

2.2.2. The system shall have one port for true  $N_2$  micropore analysis using a 0.1 Torr sensor. All ports should be able to perform  $N_2$  mesopores. Provision for high-resolution measurement in three ports with real-time dead volume correction in the 4<sup>th</sup> port should be available. Provision should be available for upgrading one more port for Microporous analysis by the addition of 0.1 Torr sensor.

2.2.3. A dedicated port with a pressure sensor to measure real-time Saturation vapor pressure. This port should be in addition to the sample ports.

## 2.3. Required External Accessories

2.3.1. A cryogen Dewar vessel (volume capacity  $> 3.2$  L with more than 80 hours holding time) should be included with the instrument being quoted.

2.3.2. A liquid Nitrogen Cryocan of 10 liters or more capacity should be offered with the instrument by the vendor.

2.3.3. A High-performance hybrid turbo pumping system should be included with the instrument being quoted. The roughing pump of vacuum system shall have dry chemical diaphragm pumping system, to achieve 1Torr or better. The ultimate vacuum level should be  $6.7 \times 10^{-7}$  Pascal or better. The system should have a dual hybrid gauge (cold cathode +pirani gauge for accuracy measurement).

2.3.4. The temperature controller should be included with the instrument being quoted and it should be compatible with our power supply (230  $\pm$ 10 V, 50-60 Hz). Accordingly, the power cord should be provided.

2.3.5. A suitable water bath to cover a temperature range of -10 °C to 70 °C along with a suitable recirculatory should be offered.

2.3.6. The entire assembly of pressure transducers and valves should be kept in a thermostatic air oven. The air oven should be kept at a temperature of 50 °C or above to ensure stable output from pressure gauges.

2.3.7. The system should have 6 or more Gas inlet ports with one corrosion-resistant port.

2.3.8. 3 sets of suitable sample cells are required for analysis which should be offered by the vendor.

2.3.9. External Degassing system should be included with the instrument being quoted with Temperature Range: ambient to 450 °C or better, Vacuum degassing for sample preparation up to 6 samples.

2.3.10. Other Required accessories (*i.e.* cryogen connection kit, Flexible Tube, 2-micron SUS filter, O-ring set, wire set, *etc.*) should be included with the instrument being quoted.

#### 2.4. Software

2.4.1. The instrument being quoted should have a remote operating facility so that researchers can take extra care of the instrument and monitor the progress of measurement and analyze the data even from home/office.

2.4.2. should display instrument status, trend chart, and real-time isotherm parallel for all the samples during measurement.

2.4.3. Default templates with measurement parameters should be available. The Software should have provision to alter measurement parameters during sample measurement. A System check program for analyzer status and diagnostics should be available.

2.4.4. Instrument schematic with valve controls should be displayed and should be easily accessible.

2.4.5. The software should display the adsorption, desorption isotherm for the sample measurements.

2.4.6. The software should be capable of calculating a specific surface area by Langmuir and BET equations.

2.4.7. The software should have the provision to measure the pore volume, pore area for mesoporous samples based on BJH, DH, CI, INNES method.

2.4.8. The software should have the provision to calculate the pore specific surface area based on adsorption/desorption

2.4.9. T plot,  $\alpha$ s plot, MP method should be available for the evaluation of Microporous samples. User should be able to create reference isotherms for t-curve and  $\alpha$ s curve

2.4.10. Different standard T curve data (at least five standard curves) should be available for data evaluation.

2.4.11. The software should have Molecular probe method.

2.4.12. The software should be capable of parallel plotting the values during measurement.

2.4.13. Features like, isotherm overlay, BET plot overlay, differential isotherm should be available.

2.4.14. The software should have the provision to export data to spreadsheet and plotting programs using the CSV file format.

2.4.15. Option to print isotherm, various plot should be available.

2.4.16. Facility to Speed up the measurement with an optimum amount of gas dosing based on adsorption isotherm data from previous sample measurement should be available.

### 3. Terms and Conditions

- 3.1. 3 years on-site warranty on all parts and labor from the date of successful installation should be quoted.
- 3.2. The tender document should also indicate what kind of service/maintenance is required for the system. Also mention that whether the service has to be carried out by a company engineer or it can be carried by trained service personnel within India.
- 3.3. Annual Maintenance Contract should be clearly mentioned after warranty period.
- 3.4. Power requirement: 220/240 Volts AC with frequency 50 Hz.
- 3.5. Operation and service manual in English (electronic and hard copy) with complete circuit diagram and PCB layout for all equipment should be provided with the instrument.
- 3.6. Standard samples to be provided by the company for testing the instruments at the time of installation on site to the quoted accuracy in the given technical specification for the demonstration of the performance of equipment.
- 3.7. Pre-installation site preparation requirements to be indicated and specified along with the bid.
- 3.8. Installation and on-site training of our staff in operation and maintenance is essential by factory trained personal in free of cost.
- 3.9. Please provide the segmented quotation for each optional measurement capabilities. Depending upon the budgetary provision and priority, the items to be purchased will be decided.
- 3.10. Bid should include all other essential auxiliary equipment and spares for its operation, even which are not explicitly specified above (please provide list with details).
- 3.11. All sample handling kits/consumables should also be provided.
- 3.12. The vendor is responsible for the installation of the system at the institute.
- 3.13. The price quotation should include the cost of installation and training of potential users.
- 3.14. GST must be not more than 5% (Institute will provide you GST exemption certificate).
- 3.15. The vendor should have a track record of having previously supplied at least five identical instruments in IITs, IISERs, NITs with above mentioned specifications. Details of such systems should be provided.
- 3.16. The vendor should have qualified technical service personnel for the equipment based in India and should assure a response time of <48 hours.
- 3.17. Vendor must provide a user list (with contact details including emails and phone numbers) of at least 5 customers from Indian Institutes/Labs where similar measurement systems are installed.
- 3.18. The lead-time for the delivery of the equipment should not be more than 6 months from the date of receipt of our purchase order.
- 3.19. The indenter reserves the right to withhold placement of final order. The right to reject all or any of the quotations and to split up the requirements or relax any or all of the above conditions without assigning any reason is reserved.

3.20. Wherever requested data must be supplied along with technical compliance documents. Technical bids without supporting data will be deemed as technically non-compliant.

3.21. All guaranteed specifications may have to be demonstrated at the time of installation. Any necessary standard samples for that purpose should be brought by the service engineers.

3.22. The vendor must provide a compliance statement in a tabular form concerning each technical specification in the tender document duly supported by the manufacturer's literature and published papers. Any other claim will not be accepted and may lead to rejection of the bid.

3.23. Technical evaluation by the institute may include a demonstration to verify functionalities and capabilities of the system quoted. The institute reserves the right to provide samples after opening the technical bids for verification of promised specifications. Any discrepancy between the promised specifications and measurements will be deemed as technical non-compliance.

3.24. The quote should also include additional spares sufficient for 3-years.