



Indian Institute of Technology, Kanpur

Department of Chemical Engineering

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Request for submission of quotation for “INSTRUMENTS FOR PHYSISORPTION AND TEMPERATURE PROGRAMMED ANALYSIS”

Sealed quotations are invited from dealers/distributors on or before 9th September 2013 with all technical specifications for the supply of items;

Enquiry No: 18/CHE/SS

Opening date: 03th September 2013

Closing Date: 09th September 2013

The quote should be submitted to the Department of Chemical Engineering, IIT Kanpur.

INSTRUMENTS FOR PHYSISORPTION AND TEMPERATURE PROGRAMMED ANALYSIS CONSISTING OF:

1) FOR PHYSISORPTION FACILITY:

1. PURPOSE:

The instrument will be used for doing Physisorption and Micropore analyses. We have identified the following general features as minimum necessary in an instrument to give us desired level of accuracy and reliability.

2. DEGASSING SYSTEM:

- 1) Number of ports: 2 (TWO) simultaneous integrated in the main instrument.
- 2) Automation: Totally automated, programmable through the main instrument software.
- 3) Degassing parameters are to be specified in the sample analysis file and to be made available on the analysis report.

- 4) Temperature:
 - Ambient to 450° C(programmable)
 - Deviation less than $\pm 10^\circ$ C of set point of thermocouple
- 5) Vacuum: A dedicated vacuum pump for degassing capable of 5×10^{-3} mmHg using two stage mechanical pump. This should be integrated in the main unit. The degas vacuum should not be shared by analysis ports.

It should be possible to transfer the sample from degassing station to analysis station under vacuum to avoid re-contamination of the reactive sample.

3. ANALYSIS SYSTEM:

- 1) Number of ports: 1 (ONE)
- 2) Vacuum pump capability: 5×10^{-9} mmHg; dedicated, this should not be shared with the degas stations.
- 3) Transducers: 3 (Three) transducers should be provided to cover the entire range of pressure measurement (0-950mmHg)

RESOLUTION:

- a. 0 to 1 mmHg Transducer: 0.000001 mmHg
- b. 0 to 10 mmHg Transducer: 0.00001 mmHg
- c. 0 to 1000 mmHg Transducer: 0.001 mmHg

ACCURACY (ANALYSIS SYSTEM):

- a. 1000 mmHg range: within 0.15% of reading
- b. 10 mmHg range: within 0.15% of reading
- c. 1 mmHg range: within 0.12% of reading

Same transducer should be used for all measurements (manifold, sample and saturation pressure) in order to avoid progressive offset and drift between separate transducers covering the same range.

4. CRYOGENIC SYSTEM:

- 1) Dewar capacity: 3 Litres which should provide 72 hours of unattended analysis.
- 2) Analysis time: Unlimited. The cryogen dewar should be refillable without affecting the accuracy of the analysis results.
- 3) Coolant level control: Should be available with a life-long warranty without involving level sensors or RTD's.

5. GAS INLETS:

- 6 Nos. for Physisorption inlets
- 1 No Vapor inlet
- 1 No Free space He inlet

- 1 No. Degas back fill inlet

Choice of gas should be selectable automatically through the software program during analysis.

6. SAMPLE TUBES:

- **Physisorption / Micropore:**
 - * ½ inch O.D. with 9cc bulb
 - * ¼ inch O.D. with 9cc bulb
 - * ¾ inch O.D. with 9cc bulb

7. SOFTWARE:

- Should use Windows interface to plan, launch and control the analysis.
- Should include features to allow cut and paste graphics scalable and editable graphs and customized reports
- Should allow degas temperatures profiles and treatment time date to be integrated with Sample file for future reference and verification of SOP compliance.
- Instrument Schematic screen display should include current analysis status and real time isotherm besides allowing the operator to assure manual control, if desired.
- Graphic display should include up to 9 (nine) overlaid graphs for easy comparison between different samples or different data reduction techniques applied to the same sample.

8. ANALYSIS REPORTS:

- Single- and Multi- point BET surface area.
- Adsorption and Desorption Isotherms.
- Langmuir surface area
- BJH Mesopore volume and Mesopore area distribution.
- deBoer t-Plot method
- MP method.
- Horvath Kawazoe with Cheng/ Yang extension and Saito/ Foley models .
- Dubinin-Radushkevich
- Dubinin-Astakhov
- Deconvolution by model fitting.
- Heat of adsorption
- α 's plots

- Freundlich and Temkin isotherms.
- Frenkel-Halsey Hill and Broekhoff-de thickness curves.
- Summary report
- **Density functional theory to generate:**
 - Porevolume distribution of Poresize
 - Surface energy
 - Surface area distribution of poresize

Using slit and cylindrical pore shape models for Argon, Co₂ and N₂ gas as adsorbate.

2) CHEMISORPTION & TPD/TPR/TPO FACILITY:

To be used for conducting experiments to study Chemisorption & TPD/TPR/TPO on samples, including, but not limited to catalysts, adsorbents, catalytic supports and ceramic materials. The following features have been identified to be necessary and hence form the basis of Technical evaluation of the offers:

- Analysis required:
 - Chemisorption
 - Temperature programmed Reduction / Oxidation and Desorption
 - Physisorption

- Analysis ports:
 - Instrument should feature two sample ports, one each for Degassing and analysis.

- Features: The Instrument should feature:
 - 4 carrier gas Inlets
 - 3 preparation gas Inlets
 - 1 injection loop
 - 1 Injection septum
 - Maximum temperature of 1100⁰ C for TPD/TPR/TPO analysis
 - Fan-assisted cooling
 - Quartz-sample reactor
 - Cold trap
 - Exhaust gases routed to external port
 - Temperature regulated TCD.
 - Stainless steel tubing for Active gases, including, but not limited to H₂, NH₃, Co, O₂, NO
 - Furnace with Controller up to 1100⁰ C with temperature ramp from 0.5⁰ C to 50⁰ C per minute

The Software should allow the following calculations:

- Peak integration.
- Volume at STP.
- Percent Dispersion
- Single point BET Surface area
- Multi point BET Surface area
- Peak area volume (Volume adsorbed)
- Calculated Stoichiometry factor
- Gram Molecular weight
- Cross Sectional area
- Calculated Metal density
- Metal surface area
- Active particle size
- Activation energy (first order Kinetics)

NOTE: Mass Spectrophotometer should also be provided

Terms & Conditions of the quotations are as under:

1. The quotations should be submitted in the properly sealed envelope, addressed to the undersigned. The enquiry no. and date should invariably be quoted on the top of the envelope.
2. The time allowed for carrying out the above note work is 7 days.
3. The rate quoted should be inclusive of sales tax and other taxes including freight charges (if any).
4. Quotations should have a validity of a minimum of 90 days.
5. The Institute reserves the right of accepting or rejecting any quotations without assigning any reason thereof.

Kindly send your quotation before respected date in the following address:

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