



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
Powai, Mumbai 400076.

Ref. No.101 (PR. No. 1000017944)

RFx No. 6100000783

Technical Specifications for Gas & Solvent Sorption Analyzer

1) Gas sorption system with physisorption and chemisorption capabilities for Microporous and Mesoporous samples

i) Low Pressure:

Sr. No.	Parameter	Expected performance
1	Operating pressure range	$\sim 10^{-6}$ kPa to ambient pressure (~ 1 bar)
2	Pressure transducers	Multiple pressure (at least 3) transducers working at suitable pressure range for accurate pressure measurements
3	Pressure resolution	~ 0.005 kPa
4	Accuracy	$< \pm 0.15\%$ of full scale over entire operating pressure range
5	Manifold	Thermostatted manifold
6	Gas Inlet Ports	At least 3, Dedicated port for He
7	Number of Sample analysis ports	3 or more (all capable of micropore analysis)
8	Adsorptive Gases	N ₂ , Ar, CO ₂ , CH ₄ , H ₂ , O ₂ , Kr, CO, Ethane (C ₂ H ₆), Butane (C ₄ H ₁₀), Acetylene (C ₂ H ₂), and other non-corrosive gases.
9	Gas sorption Measurement Temperature Range	77 K to at least 323 K Dewar vessel should hold Liq. N ₂ at least for 60 h.

		Re-circulated bath for ambient and above ambient temperature measurements
10	Analysis Software Capabilities:	<ul style="list-style-type: none"> 1) Adsorption and Desorption Isotherm, 2) PCT Curve 3) BET plot (single point, Multi point) 4) Langmuir plot, 5) Mesopore size distribution Analysis (DH, BJH, CI, INNES plot) 6) Micropore size distribution (MP, HK, SF plot) (range 0.35 to ~ 500 nm), 7) Total Pore volume (detectable within 0.0001 cc/g) 8) t plot 9) α_s plot 10) DA plot 11) Metal dispersion analysis 12) Isothermic heat of adsorption 13) Difference of Adsorption Isotherm 14) Molecular probe plot 15) NLDFT/ GCMC pore size distribution and other standard software features
11	Sample Pretreatment unit:	<p>Separate unit capable of treating at least 3 samples at a time.</p> <p>Pre-treatment temperature range 40 to 550 °C.</p> <p>Programmable heating/cooling sample pre-treatment parameters</p>
12	Reference Material	<p>Suitable reference material for calibration/check</p> <p>(Carbon, Zeolite, Silica based)</p>

ii) **High Pressure:**

Sr. No.	Parameter	Expected performance
1	Operating pressure range	Ambient to at least 50 bars
2	Pressure resolution	<±0.1%
3	Accuracy	<±0.05% f.s
4	Pressure transducers	Multiple pressure (at least 3) transducers working at suitable pressure range for accurate pressure measurements
5	Gas Inlet Ports	Multiport gas inlet system (at least 2)
6	Adsorptive Gases:	N ₂ , Ar, CO ₂ , CH ₄ , H ₂ , O ₂ , Kr, Water vapour, CO, Ethane (C ₂ H ₆), Butane (C ₄ H ₁₀), Acetylene (C ₂ H ₂), and other non-corrosive gases.
7	Measurement Temperature Range	77 K to at least 323 K
8	Software capabilities	Isotherm: Surface excess or amount adsorbed, storage capacity Kinetics of Gas sorption Heat of Adsorption Isotherm overlay Etc.
9	Sample Pretreatment unit:	1) Separate unit capable of treating at least 3 samples at a time. 2) Pre-treatment temperature range 40 to 550 °C. 3) Programable heating/cooling pretreatment parameters

iii) **Chemisorption:**

Sr. No.	Parameter	Expected performance
1	Chemisorption/ Reactive gas adsorption	Capable of studying NH ₃ , CO ₂ , and F containing molecules

2	Chemisorption Furnace	1) Sample activation and measurement facility 2) Operating temperature 40 °C to 1100 °C 3) Programable heating/cooling pretreatment parameters
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2) Solvent sorption Analyzer:*

Sr. No.	Parameter	Expected performance
1	Adsorptive Solvents	H ₂ O, MeOH, EtOH, butanol, Iso-propanol, Benzene, Cyclohexane, Toluene and other non-corrosive solvents.
2	Measurement Temperature Range	77 K to at least 323 K (50 °C)
3	Required Sample amount	~20 to 200 mg
4	Solvent Degassing Facility	In-situ solvent degassing facility

*Other parameters would be similar to that of low-pressure sorption system.

- 3) Easy switching between gas to solvent vapor adsorption measurement preferably by software controlled manifold purging or adsorbate exchange program.
- 4) Appropriate computer station with good configuration, UPS, batteries to run the system for at least 60 minutes in the event of a power failure.
- 5) Appropriate Gas cylinders with regulators, SS tubing, nuts, Ferrules & connectors for gas connections etc. should be provided.
- 6) Comprehensive warranty with all the consumable and spare parts required for 5 years.

This includes replacement of damaged parts and engineering/service support at the cost of the supplier. In case, the machine is down for more than 1 week during the warranty period, number of days accordingly should be compensated by providing additional extended warranty free of cost.

- 7) The system should also include:

Sr. No.	Parameter	Expected performance
1	Coating on inner walls of gas/solvent vapor transporting metal tubes and sealing	Special coating to handle the corrosive gasses

2	Chemisorption	Temperature programmed desorption, oxidation and reduction (TPD, TPO and TPR) and pulse titration (automatic loop injection).
3	Gas switching	Software controlled multi-gas port switching unit
4	Hydrophobicity Measurement	Hydrophobicity and hydrophilicity measurement