TECHNICAL SPECIFICATION FOR 'BENCHTOP VAPOR SORPTION ANALYZER'

Sl. No.	Description
1	**Basic Configuration**
	Automated benchtop ultralow-mass microbalance gravimetry-based real-time (dynamic mode) water-vapor sorption / desorption system to study water-vapor kinetics. System should be suitable for study of water sorption isotherms for polymer thin films as a function of relative humidity and temperature.
2	**Gravimetry Specifications**
	a.) Ultra-low mass balance capacity of 1000 mg or more
	b.) Range of 150 mg or more
	c.) Weight Resolution of 0.1 micrograms (0.1 µg) or lower
	d.) Design ensuring no water condensation on the microbalance during the operation at different humidity.
3	**Relative Humidity Specifications**
	a) Humidity control based on wet/dry gas mixing at a constant total mass flow rate using precision mass flow controllers. with feedback control. Humidity Set-point and ramp to set-point regulation using feed-back control.
	b) Relative Humidity range of 0 to 98 % (or wider range) throughout the entire temperature interval of 5 to 50 ^{o}C (or wider range).
	c) Calibrated humidity values based on deliquescence of saturated salt solutions obtained with multiple humidity set-points across the humidity range.
	d) Relative Humidity absolute accuracy of 2 % (or lower) throughout the above specified humidity range.
	e) Relative Humidity resolution of ± 0.2 % (or lower).
	f) Gas supply provision compatible with dry air or nitrogen with industry standard compression fittings.

4	**Temperature Specifications**
	a.) Temperature control including set-point and hold, with feedback.
	b.) Sample temperature interval of 5 to 50 ^{o}C (or wider)
	c.) Temperature accuracy of 0.1 ^{o}C (or lower)
	d.) Any accessories or parts needed to achieve complete temperature control must be included with the system.
5	**Software Specifications:** Automated system control for setting measurement process. Real-time vapor kinetics measurement with analysis and data export options.
6	**Computer system:** Computer (either in-built or externally connected): Branded PC with licensed Windows-10 OS and control software for complete operation of the system
7	**Sample holders and accessories:** Complete set of standard sample holders, pans and wire hang-downs for mounting polymer thin films, powder samples. Standard tools, reference materials, calibration support for operating the system.
8	**Power requirements:** Single phase, 200 to 250 V, 50 to 60 Hz.
9	**Operational Manual:** Instrument description manual; Operation manual; All individual component details of the system; The procedures of allowable detachment/replacement.
10	**Installation and Commissioning:** Factory calibration reports for key system performance characteristics should be sent ahead of shipment. After receipt of the item at IIT Madras, the complete system shall be integrated, installed and commissioned at the designated place by vendor's representative. Performance characteristics as per instrument's specifications including temperature ramp rate, temperature range of operation, humidity ramp rate, humidity range of operation, stability of temperature and stability of humidity, calibration of humidity values and calibration of microbalance must be demonstrated on-site for acceptance of

	the installation. The vendor's representative should also provide complete hands-on training on operation and use of the software after installation and commissioning.
11	**Training:** After installation, complete on-site training by a specialist on both instrumentation and advanced data analysis.
12	**Warranty:** The Warranty on the system should be for 3 years from the date of installation.
13	**Service:** The support of local service team in India is mandatory. In addition, online technical support should also be provided.
14	**Spares:** complete set of standard spares and consumables that may need replacement.
15	**General Specifications:** At least 2 similar systems must have been supplied and installed by the vendor in India.
16	**Optional items (depends on the requirements)** a.) Temperature stage allowing wider range above 50 ^{o}C
	b.) Option for weighing range different from the standard weighing range to handle samples of variable mass or sorption.
	c.) Sample cell for testing membrane permeation. Membrane should separate controllable humidity on one side and liquid saturated salt solution.
	d.) Vibration control stage.
	e.) Pre-heater module to treat the mounted sample up to 200 ^{o}C or more prior to the sorption experiment.
	f.) Performance evaluation kit for periodic verification of calibration of the system parameters such as humidity set-points and microbalance.