

Tender Notification for the procurement of an Ultra High Vacuum (UHV) sputtering system

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Dear Sir/Madam,

Kindly send the lowest quotation for the following item on C.I.P. Bangalore basis. The quotation should clearly indicate the terms of delivery, delivery schedule, transportation charges, if any, payment terms etc. The general terms and conditions are given in the last section below.

Technical specification of the UHV sputtering system

1. General information:

- i. Materials to be deposited – Al, Nb, Ta, Ti, W, NbN, NbTiN
- ii. Technique – DC magnetron
- iii. System base pressure – smaller than $2e-8$ mbar in less than 24 hours when all parts of the chamber are fully vented. Include a Chamber Bakeout Package, if needed, to reach the specified base pressure.
- iv. Process pressure – $1e-3$ to $1e-2$ mbar with Ar background or Ar+N₂ background as per the range of the flowmeters specified below.
- v. Minimum plasma ignition pressure should not be larger than $1.5e-3$ mbar with 50-Watt DC power.

2. Main deposition chamber:

- i. Cylindrical chamber of approximately 40 cm height (outer diameter), SS304 electropolished.
- ii. The bottom flange should have the provision of accommodating seven sputter sources in confocal positions and one sputter source positioned at the center. The sealing of the flange with the chamber must be UHV compatible.
- iii. Water-cooled chamber with flow sensors.
- iv. Gate valve between the main chamber and the pumping system.
- v. One spare CF 8" on the side of the chamber (not in the line-of-sight with the source).
- vi. Two CF 6" (preferable) viewports with shutter.
- vii. Enough ports to introduce the process gases.
- viii. All unoccupied ports must be blanked off.

3. Load lock specification:

- i. Low volume load lock with easy access for loading and unloading.
- ii. Load lock must be able to reach a pressure of $1e-6$ mbar in less than 6 hours (without any sample).
- iii. Transfer-arm system with the transferrable substrate carrier.
- iv. All necessary vacuum gauges for the full range of pressures from base pressure to atmospheric pressure.
- v. Manual gate valve (preferably VAT) between the main chamber and load lock.

4. Vacuum pumping system:

- i. Main Chamber – Brooks CTI-8 straight cryopump with compressor (OR equivalent), temperature sensors, necessary lines, and cables.
- ii. Roughing valving for cryopump system.
- iii. A suitable dry pump for regeneration. Preferably from Edwards Vacuum or Pfeiffer Vacuum.
- iv. Load-lock pumps – Turbo Molecular Pump with capacity 60 LPS or more, including controller, necessary plumbing, and hardware. A suitable backing pump, preferably from Edwards Vacuum or Pfeiffer Vacuum.
- v. All vacuum pumps must be controlled outside of the system software (via breaker) to ensure on/off unison, pump safety, and potential software issues do not prevent vacuum pump operation

5. DC magnetron Sputter source:

- i. Three 2" sources with integrated shutter and gas injection system via the VCR ports, including isolation chimneys to avoid cross-contaminations. The sources should be placed in a confocal manner
- ii. One 3" source at the center of the flange with gas injection system via VCR port, including isolation chimney
- iii. All sources must be capable to withstand system bakeout at 200C without the removal of magnets.
- iv. The sources must be designed to achieve deposition uniformity within 5% over 3" diameter at the sample holder position. Nominal source to sample distance – 150 mm
- v. Each source must have a pneumatically controlled shutter.

6. Power sources:

- i. 1x – At least 500-Watt DC generator with 4-way switch selector and necessary cable set. DC Power supplies must allow for simultaneous display of voltage, current, and power on the active front panel for diagnostic purposes. Changing the display between different parameters is not desired.
- ii. Power supplies (including the ones listed under optional items) must have kW hour monitoring ability
- iii. DC power supply must provide stable plasma under the following conditions: 1W at 3e-3 mbar pressure

7. Vacuum gauges and controller:

Include suitable pressure controller and gauges in the load-lock, fore-line, and main chamber for the complete operation of the system (including the automatic process pressure control). Include the details in the technical compliance document.

8. Substrate holder:

- i. It must accommodate 4"-substrate, 3" and 2"-substrate, as well as small pieces (5mm x 5mm). Provide multiple substrate holders if one holder cannot accommodate the different sizes listed above.
- ii. Confocal configuration on the vertical central axis of the main chamber
- iii. Continuous motorized rotation with speed up to 20 RPM with the controller. Substrate rotation must be compatible with RF bias of the holder.
- iv. Halogen lamp-based sample heater to achieve temperature up to 750 C, including a PID temperature controller, stability +/- 1 C.

- v. Substrate gas ring to inject process gas near the substrate.
- vi. Must have electrical connection and feedthrough to bias the substrate with RF and DC.
- vii. Pneumatically controlled substrate shutter

9. Process gas manifold:

- i. Mass flow-controlled gas line for Argon to control flow up to 100 sccm with isolation valves and filter
- ii. Mass flow-controlled gas line for Nitrogen to control flow up to 20 sccm with isolation valves and filter
- iii. Ar gas line should be plumbed to all the 2" sources, with control valves to direct the flow to one or all sources
- iv. N₂ gas line should be plumbed to the substrate and the central source for reactive sputtering.
- v. Pressure control during deposition - Multi-position/Butterfly valve based automatic controller with VAT series 64 closed loop

10. Instrumentation rack:

- i. Welded stainless steel frame
- ii. Chamber must not be enclosed with the panels
- iii. Loadlock must not be enclosed with the panels
- iv. The coating on the rack must be cleanroom compatible.
- v. Utilities must be located at the backside of the rack.
- vi. Adjustable leveling feet
- vii. The rack should have enough space to include all power supplies (including the ones listed under the optional items)

11. Automation and safety:

- i. Control software with rack mount computer, mouse, keyboard, etc
- ii. Interface with DC and RF (precleaning) sources to control DC and RF power, output mode, plasma detection, and fault alert.
- iii. Interface with 4-way DC switch box
- iv. Interface with solenoid/pneumatic manifold for control of shutter, gas isolation valves.
- v. Interface with VAT valve for open/closed/throttle position
- vi. Interface with substrate heater controller – ON, OFF, setpoint closed-circuit feedback
- vii. Interface with substrate rotation controller (on/off)
- viii. Interface with all the MFCs for gas correction factor, flow setpoint.
- ix. The software should have the ability to create a single recipe containing multiple layers with different deposition parameters. Ability to store and run the recipes. Monitoring and data logging
- x. Separate password protection for user and manager account.
- xi. Auto Shutdown of power supplies. Auto abort of a process if the parameters are not matched as specified in the recipe
- xii. The software should display – the shutter position, DC power, RF power, plasma verification, process pressure, base pressure, process-flow, substrate temperature.
- xiii. Interlock on the manual gate valve between the load-lock and the main chamber
- xiv. In the event of power failure – All critical controllers should have a built-in battery pack to handle the power fail event and shut the controlled isolation valve in case of power failure.
- xv. Interlocks - The system must have interlocks such as on the chamber vacuum levels, cooling water, etc. Further, the system is to be designed to handle power failure events without any damage to pumps and e-beam supply. Include these details in the technical document, else it would lead to the disqualification of the bid.

- xvi. Must include Software Emulator, which allows remote recipe creation from outside lab to allow creation/modification of extensive recipes

12. Other details:

- i. Include the length of He-bellows for the cryo-pump (distance between cryo-pump and compressor) in the technical document.
- ii. Include liners to prevent chamber wall deposition and additional substrate holder (optional item).
- iii. The control system (Pump controller, PC/Laptop, different controller.) must be inside a rack cabinet. Provide system assembly details in the technical document.
- iv. The vendor should have previous experience of supply of similar UHV DC magnetron sputtering equipment in the Indian Institutes and Research Organizations. Provide a list of Indian/Foreign customers (giving name, address, email, phone) with similar systems, where the base-pressure mentioned above has been demonstrated.
- v. Include the pictures of similar sputter guns configuration, design, and proof of experience
- vi. Testing documentation on low power operation (20 W)
- vii. The vendor must submit the optimized recipes for reactive sputtering to support the claim for NbN and NbTiN deposition.

13. Warranty:

- i. Comprehensive warranty and support for at least 1 year

14: Optional items:

- i. A 100W RF source for pre-cleaning of the substrate, including necessary cable, matching network, etc.
- ii. A 200W or higher power RF source for deposition, including matching network and necessary cable for integration in the system.
- iii. A pulsed DC source with 2 kW Output Power, 800 V Output Voltage, up to 100 kHz output frequency
- iv. A 200 V DC source for sample bias during deposition
- v. Include the reduction in price if the central source mentioned in 5(ii) is to be replaced by a 2" source. In this scenario, mention if the uniformity specified under 5(iv) can be met.
- vi. Include a chamber bake-out kit for the improvement in the base pressure.
- vii. Additional 2 years warranty plan beyond the mandatory 1-year comprehensive warranty. plan

General terms and conditions:

1. After the award of the Purchase Order (PO), the vendor must provide an Order Acknowledgement within 21 days from the receipt of the PO.
2. The lead time for the delivery of the equipment should not be more than 16 weeks after establishing the payment mode. The delivery time should be mentioned in the technical and commercial bids.
3. Vendors must provide an original warranty certificate and original invoice with the system from OEM for all **imported items**. Vendors must submit a copy of the air waybill for all imported items.
4. Drawings must be submitted for approval after the purchase order release and before the manufacturing of the system commences.
5. The base pressure should be demonstrated after completing the installation at IISc.
6. All the feedthroughs and welded joints to be He-leak tested with background $< 1 \times 10^{-9}$ mbar-l/s at the time of installation.

7. Training for 2 users from IISc should be provided to make them well familiar with the operation of various components and successful growth of the thin films using the given deposition unit at IISc.
8. Deposition uniformity must be demonstrated using an in-house ellipsometry monitor at the time of acceptance of the system.
9. Payment terms should be mentioned in the technical bid.
10. The purchase of optional items (where the price is asked separately) is subject to budgetary constraints.
11. The commercial bid and technical bids must be submitted in two separate envelopes. A technical bid must contain a point-by-point technical compliance document. The technical bid must not contain any price information.
12. A pre-tender meeting for any technical clarifications can be scheduled with the undersigned by sending an email.
13. IISc is registered with DSIR for availing custom duty exemption (CDE) for import orders and GST exemption (for INR orders in India). IGST is NIL for import order for IISc. Bidders should consider all these facts while submitting their bid. For import order, the Bill of Entry must be in the name of IISc for availing CDE. GST exemption certificate will be provided subject to the submission of the proforma invoice.
14. The purchaser reserves the right to accept or reject any bid and to annul the bidding process and reject all bids at any time before the award of contract without thereby incurring any liability of the affected bidder or bidders.

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