Global Tender Notification for the procurement of an Ultra-High Vacuum (UHV) electron beam evaporation system with ion-source, oxidation chamber, and load-lock

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A request for quotation from interested manufacturers for an Ultra-High Vacuum (UHV) electron beam evaporation system with ion-source, oxidation chamber, and load-lock. The quotation should clearly indicate the terms of delivery, delivery schedule, transportation charges (if any).

All interested vendors shall submit a response demonstrating their capabilities to produce the requested equipment to the primary point of contact listed below. **The last date for submission of proposals is 07-Aug-2022, 5:00pm**. Proposals should arrive at the Department of Physics, Indian Institute of Science, Bangalore-560012 (INDIA). Mention the reference No. on the envelope clearly.

Any question concerning this tender can be directed to Ms. Rekha Varadaraj at **vrekha@iisc.ac.in**

Enclose a compliance certificate along with the bid. This certificate should have a table that should describe your compliance in a "Yes" or "No" response against each of the items in the specifications listed below. If "No" is selected, the second column should state the extent of deviation. The third column should state the reasons for the deviation (if any). Please enclose a compliance statement along with the technical bid. Bids with no statement of compliance will be considered invalid.

The technical details of the system and general terms and conditions are given below.

Technical details of the system:

General design layout: A design based on three-chamber system, where main chamber houses the e-gun source, as described under point A below. The second chamber would be used for the sample cleaning or controlled oxidation. Its technical details are provided under point B below. The third chamber is to enable the loading of substrate-holder with a magnetically coupled transfer arm. Its technical details are described under point C.

(A) Main chamber:

1) Chamber design: A chamber with bead blasted or electropolished finish. UHV designed. Approx. Inner diameter 550 mm, and height of 400 mm. Chamber must have all the necessary flanges, ports, and pumping sequences for the operation of the entire system. One blank CF40 flanges for upgrade in future. Hinged front or top door with differential pumping of O-rings. A CF63 or comparable viewport with shutter and polarizer for process monitoring. A set of stainless-steel chamber liner to prevent coating on inner chamber surface, easily removable for cleaning, along with a spare unit. Water-cooled chamber body with flow sensors. All unoccupied port must be blanked. Minor variations in the chamber-shape, dimensions, and number of ports are acceptable if they do not affect the system performance.

2) Pumping system: Guaranteed Base vacuum < 1e-8 Torr. Dry rough pump of nominal capacity 15m3/h. Cryo-pump CT8 1500 l/s air. Include complete regeneration module, water cooled compressor. CF200 gate valve, bellow sealed. A roughing valve system for the

chamber. The roughing pump can be shared with load-lock pumping system, see point C-2 for detail.

3) **Pressure gauge system:** CF40 Pirani/Bayard Alpert gauge (1 atm to 5e-10 mbar) or equivalent. Membrane gauge for atmospheric pressure detection (1/4 VCR). VCR venting valve, electro pneumatic controlled.

4) E-beam Source: UHV linear multi-pocket gun from Thermionics or Telemark. Crucible should be easily accessible from the door for easy filling of liners. 5×15cc crucible pockets. Linear movement. Solid state 6 kW power supply. HV must be adjustable from 2 to 10 kV. Emission current up to 600 mA. Digital XY sweep controller. Programmable patterns, automatic selection with the crucible choice. Automatic crucible selection, together with the X-Y pattern. Pneumatically actuated source shutter.

5) Substrate holder: Holder compatible for at least 3" wafers as well as small pieces, mechanically clamped. A DC motor to tilt the substrate from 0° with a programmable angle. Accuracy and reproducibility better than 0.01°. A stepper motor with integrated control and encoder to achieve substrate rotation of 5 rpm and to allow the azimuthal positioning of the substrate for double angle evaporation. Reproducibility better than 0.1°. Ferro-fluidic sealing for tilt (rotation) arm, Wilson-seal/O-ring seal is not acceptable.

An opto-switch to home position for transfer purposes. Source to substrate distance should be approx. 550 mm. An electro-pneumatic substrate shutter for substrate protection prior to deposition.

6) Thickness monitoring: One UHV single xtal-head to control the evaporation rate and thickness. Easily accessible for quartz replacement. The head must view the source to control the rate before opening the substrate shutter. All-important graphs and controls must be displayed simultaneously on a single window. Thickness resolution of 0.1 A.

(B) Cleaning/Oxidation chamber:

1) Chamber design: Purpose for this chamber is static/dynamic oxidation, ion cleaning, Deposition of evaporated film on the substrate by the shadow deposition technique. Base pressure < 2e-8 Torr. The bead blasted or electropolished stainless steel chamber approx. 350 mm in diameter and is 270 mm tall. It should have hinged stainless steel top lid with differential pumping of the O-ring. A CF-200 stainless steel bellows sealed, or equivalent gate valve should separate the source chamber from the oxidation chamber load lock, allowing the source chamber to always remain at high vacuum. The chamber must have all necessary flanges and port to allow oxidation, in-situ ion milling with a KDC source, venting, pressure gauges to monitor pressure during the oxidation, milling and idling.

2) Pumping system: A turbo molecular pump (TMP) with 700 l/s capacity backed by 15m^3/h dry pump. All necessary interconnecting pumping lining, cables, and controllers. A bellow sealed CF 250 gate valve with multi positions throttling, including the controller. A roughing valve for the chamber to allow pump down after oxidation step.

3) Pressure gauge system: The pressure gauge system should cover 1×10^{-3} – 1×10^{-9} Torr range and a membrane (capacitive gauge) to cover 0.1-10 Torr range. Electro-pneumatic controlled venting valve with VCR fitting.

4) Substrate holder: The sample stage must have the sample tilting and rotation ability as described under “Substrate holder” heading above (see point 5 under heading A).

5) Substrate cleaning: A Kaufman source KDC40. Include MFCs and electropneumatic stop valve to regulate the oxygen and Ar flow. Include the KSC1202 ion beam controller. KDC ion source details - Mo divergent beam grids. Uniformity on 3''. Ion energy: 100 - 1000 eV. Beam current up to 100 mA. Include a mass flow controller gas line 100 sccm with pneumatic isolation valve and filter. The built-in gas line connection on KDC must be used for ion-milling process.

6) Oxidation hardware: This manifold should allow the oxidation in two modes. (a) Static oxidation - It should include two electro pneumatic stop valves and a needle valve. The needle valve should be placed between the stop valves. The time to get the static pressure required should be adjustable. (b) Dynamic oxidation (up to 5×10^{-2} Torr). A 20 sccm mass flow controller to set the pressure during dynamic oxidation.

Small variations in the chamber-shape, dimensions, and number of ports are acceptable if they do not affect the system performance substantially.

(C) Sample load lock with transfer arm:

1) Chamber design: Electropolished or bead-blasted stainless steel vacuum chamber with hinged top lid and viewport. Approx. size 200 mm in diameter, 100 mm high and it is mounted on the CF 160 electropneumatic transfer valve. The 3'' sample mounted on a carrier can be loaded by hand or motor on the transfer fork. Magnetically coupled transfer arm with UHV compatibility. Include suitable bellow sealed gate valve, viewports, and vent valve for smooth loading of the sample. Transfer arm must be suitably supported.

2) Pumping system: TMP with capacity of 80 LPS with suitable dry pump of nominal capacity ~15 m^3/h. The dry pump may be shared for main-chamber roughing, cryo-regeneration. It may also be used for roughing the cleaning chamber after the static oxidation step. Provide suitable valves and pumping line manifold.

(D) System Control:

Control Unit: Centralized control unit comprising all electronic and electrical components including control PC. Cleanroom compatible cabinet of approximate size 800 mm x 800 mm x 1800 mm. Suitable interlock system to fail-safe operation of the system. Emergency breakers.

Computer must be interfaced –

- to control all the shutters, pneumatic control valve, gas isolation valves, gas flow rate during oxidation and cleaning process, rotation, and tilt of the sample holder stage.
- with KDC ion source to control discharge voltage, beam current, accelerator voltage, beam voltage.
- Rotation and tilt control of sample in cleaning/oxidation chamber.
- Positioning and indexing of e-beam crucibles

Software: State of the art software (in English). This software must allow manual, semi-automatic and fully automatic control of the equipment. The software should support the user, super-user and service accounts with programmable privileges. It must log all the critical system parameters such as base pressures and user recipes details.

Warranty: Comprehensive warranty and support for at least 1 years. Include option for extended warranty for two additional years.

DELIVERY TIME: Maximum 7 months from the date of Order Acknowledgment (OA). The vendor must provide the OA within 3 weeks after receiving the purchase order. After the award of the Purchase Order (PO), the vendor must provide an Order Acknowledgement within 21

days from the receipt of the PO. The delivery time should be mentioned in the technical and commercial bids.

General terms and conditions:

- Vendor 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.
- Vendor must have prior experience in manufacturing similar system and must submit list of at least 5 customers with contact information, and details of the supplied system.
- Drawings must be submitted for approval after the purchase order release and before the manufacturing of the system commences.
- The base pressure should be demonstrated after completing the installation at IISc.
- 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.
- 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.
- Deposition uniformity must be demonstrated using an in-house ellipsometry monitor at the time of acceptance of the system.
- Payment terms should be mentioned in the technical bid.
- 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.
- 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.
- The bids can be addressed to “The Chairperson, Dept. of Physics, Indian Institute of Science Bangalore-560012”