INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

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Technical Specifications of Dual Chamber Sputter System

Inter connected Dual Sputter Deposition Chambers with common load lock and other facilities.

Inter connected Dual Sputter Deposition Chamber System should have minimum following specifications:

A) Sputter Chamber No.1:

1) Cylindrical style chamber, 304L SS, electro-polished (box-style chamber not desired)
2) Chamber diameter must not exceed 14” ID (this allows for faster-pumpdown times)
3) At least two 6” CF viewports with integrated shutters, capable of removing shutter drive without breaking vacuum preventing inexperienced users from operating shutter
4) Three Ports available for gauge heads
5) Ports available for RGA
6) Ports for thickness monitor
7) At least sevenfor periphery 2” confocal sputtering source ports and One 2” or 3” direct deposition source port on chamber center axis.
8) Chamber designed to incorporate load-lock via 8” CF flange
9) All chamber ports must be metal-sealed with exception of top lid
10) Chamber must be designed to incorporate RHEED as future upgrade. Vendor must guarantee RHEED compatibility without the need for additional magnetic shielding.
11) All unused ports must be blanked off
12) Additional8” CF port located opposite load-lock for connection to Sputter Chamber No.2
13) Includes manual isolation valve between Chamber No.1 and Chamber No. 2.
14) Internal and external photos of OEM’s previously manufactured system with similar dual-chamber layout must be submitted along with tender.

B) Sputter Chamber No. 2:

1) Cylindrical style chamber, 304L SS, electro-polished (box-style chamber not desired)
2) Chamber diameter must not exceed 14” ID (this allows for faster-pumpdown times)
3) At least Two 6” CF viewports with integrated shutters, capable of removing shutter drive without breaking vacuum preventing inexperienced users from operating shutter
4) Three Ports available for gauge heads
5) Ports available for RGA
6) Ports for thickness monitor
7) At least sevenfor periphery 2” confocal sputtering source ports and One 2” or 3” direct deposition source port on chamber center axis.
8) Chamber designed to access load-lock via Chamber No. 1 using 8” CF flange
9) Includes transfer arm support hardware to minimize transfer arm sag
10) All chamber ports must be metal-sealed with exception of top lid
11) Chamber must be designed to incorporate RHEED as future upgrade. Vendor must guarantee RHEED compatibility without the need for additional magnetic shielding.

12) All unused ports must be blanked off
13) Spare 8" CF port located opposite Chamber No. 1 for future expansion
14) Internal and external photos of OEM's previously manufactured system with similar dual-chamber layout must be submitted along with tender.

C) Instrument Rack:

1) Welded stainless steel frame with open frame work design
2) Single Instrument rack must accommodate Chamber No. 1, Chamber No. 2, and load-lock in side-by-side orientation. Individual instrument racks for each chamber are not acceptable.
3) Chambers must not be enclosed with panels
4) Load-lock must not be enclosed with panels
5) Durable powder coated table top required for available workspace
6) Utilities must be located on backside of instrument rack mounted in removable boxes for ease of access (please show picture of design)
7) Instrument rack must have space available to accommodate additional future power supplies (In addition to those listed in the description)
8) Instrument rack must have adjustable leveling feet to allow ≥12 mm of height adjustment for future transfer alignment with adjoining vacuum chamber
9) Instrument rack and electronics cabinet must be one welded assembly. Detachable instrument rack is not preferred

D) Vacuum Pumps:

1) TwoPfeiffer Hi-Pace 700 l/s turbopump with delayed vent valves (One for each chamber)
2) Two Edwards 6cfm rotary vane mechanical backing pumps
3) Interconnecting plumbing and hardware
4) 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

E) Sputtering Guns:

1) Each chamber is capable of accommodating up to (Seven) 2" UHV magnetron sputtering sources in con-focal orientation
2) Each chamber is capable of accommodating (One) additional sputtering source, evaporation source, or in-situ stress measurement device on bottom center axis of chamber
3) Each chamber includes (Three) 2" con-focal magnetron sputtering sources with chimney, pneumatic shutter, and individual gas injection capability.
4) Pneumatic shutters for confocal sources must be flip-top style. Domed style or rotary style are not acceptable.
5) 2" sputtering gun must be able to accommodate up to 0.125" thick magnetic targets, including pure iron.
6) All guns must have modular magnet design to allow balanced, unbalanced, and magnetic material configurations. Dedicated gun for magnetic material sputtering is not accepted, must have versatility.
7) Magnets must be located in vacuum, outside of cooling water, with Curie point of 200C.

8) UHV sources must be bakeable to 200C, eliminating the need to remove magnets prior to system bakeout
9) Vendors must be able to provide specialized backing plates, targets, and clamping rings for dielectric materials that are inherently brittle. In order to eliminate additional target stress, the clamping ring must not clamp down on the target material itself. Pictures of this design must be provided.

F) Power Supplies:

a) DC Generators

1) Include two nos. 750W DC power supply with integral automated 4-way DC switchboxes (to be shared between chambers)
2) Power supplies must allow for simultaneousdisplay of voltage, amperage, and power on the active front panel for diagnostic purposes. Changing display between different parameters is not desired.
3) Power supplies must have ability to control shutter actuation to allow manual operation outside computer control.
4) Power supplies must have kW hour monitoring ability
5) DC power supply must provide stable plasma under the following conditions: 1W at 2mTorr pressure

b) RF Generators

6) Include one 300W RF power supply with auto matching network (to be shared between chambers)
7) Include one automated 4-way RF switchbox (to be shared between chambers)
8) Include One100W RF power supply with auto matching network for substrate biasing for Chamber No.1
9) RF power supplies must provide stable plasma under the following conditions: 3W at 3mTorr pressure

G) Vacuum Gauges:

1) Each chamber must include a dedicated gauge package thatconsists ofone Convectron gauge, one 0.1 TorrBaratron gauge, and onecold cathode gauge.
2) Vacuum gauge controllers must have ability to display up to three gauge heads

H) Chamber No. 1 Substrate Holder:

1) Accommodates up to 3” diameter
2) 0-40RPM rotation
3) Must allow uniform heating to 850C via quartz halogen lamps
4) Capable of heating in O2 environment
5) 2” Z-motion for target-to-substrate height adjustability
6) Must have Dual PID heater control that automatically switches between high/low temp range without manual tuning
7) Overtemp protection +/- 1 degree C temp stability
8) Must include RF biasing capability of ≥50W while rotating / heating / depositing with dedicated 100W RF generator and auto-matching network

I) Chamber No. 2 Substrate Holder:

1) Accommodates up to 3” diameter

2) 0-40RPM rotation
3) 2” Z-motion for target-to-substrate height adjustability

J) Gas Handling:

1) OneMFC gas line for Ar (100 sccm)
2) Ar plumbed to One sputtering source in each chamber ((Two) total) via diverter valve
3) MFC must include necessary plumbing/hardware to all process gas delivery to Chamber #1 or Chamber #2 sequentially

K) Pressure Control:

4) Each deposition chamber must include OneVAT Series 64 automatic pressure control for turbopumpisolationand throttling (8”CF size) (total of two VAT Series 64 valves).
5) Automatic venting via turbo delayed vent valve on each chamber
6) Manual vent valve on each chamber
7) Systems must be designed for downstream pressure control (upstream pressure control is not desirable) for maximizing turbo pump life, better gas flow resolution for reactive processing and less gas consumption.

L) Load Lock:

1) Aluminum chamber body machined from a single billet
2) Minimum Pfeiffer 80 l/s turbo molecular pump.
3) Minimum 4 cfm mechanical dry backing pump
4) Full range vacuum gauge
5) Includes manual hand-crank actuator on transfer arm to allow user to look through viewport at any stage of transfer while actuating arm
6) Transfer arm must have heavy duty aluminum shaft to minimize transfer arm sag (transfer arm thickness must be specified when submitting quotation)
7) Load-lock must be located outside of electrical cabinet for easy atmospheric access (may not be enclosed)
8) Load-lock must be capable of reaching base pressure of 5.0×10^{-7} Torr or better
9) Includes VAT manual isolation gate valve between Chamber No. 1 and load-lock

M) Power Distribution system and pump control:

1) System must take single phase, 30A, 208 VAC input voltage.
2) Include water and vacuum interlocks
3) Water and vacuum interlocks must be tied into Mains power to prevent operation of power supplies without interlocks being satisfied. This prevents users from operating power supplies without proper safety restrictions in place.
4) Include breakers for vacuum pump control, allows single breaker to turn turbo and mechanical pump on/off. Ease of operation for pump safety.
5) Power distribution system must be designed to power all required components from both chambers

N) Computer Control:

1) Computer control software must be designed to control either Chamber #1 or Chamber #2 sequentially

2) Computer control software must be LabVIEW based
3) Must use Windows 10 OS
4) Interfaces with up to (Five) DC & (Four) RF generators for control of output mode, setpoint, ramping & plasma detection
5) Interfaces with (Two) 4 way DC switchboxes and (One) 4 way RF switchbox
6) Interfaces directly with solenoid pneumatics manifold, for control of shutters, gas isolation valves & spares
7) Interfaces with VAT valve for: open / closed / throttle position
8) Interfaces with Substrate Holder closed-loop PID heater controller for: on / off / temp. setpoint / T/C temp. feedback
9) Define and stack process layers to create processes
10) Monitoring and data logging kW hrs. in software:
11) 100+ separate password protected accounts for process layer & process security
12) Auto shutdown of power supplies if: plasma not detected
13) Auto abort of process if: plasma not detected / gas flow setpoint or temperature setpoint not reached
14) Displays and data logs: shutter position / DC power feedback / Pulse Frequency and Reverse Time / DC bias feedback (for RF) / plasma verification / process pressure / gas flow feedback / T/C temperature feedback / target kW hours / Abort Notifications
15) Pre-wired receptacles to allow ease of upgrade
16) Recipe creation
17) LabVIEW software must utilize analog communication

O) Guarantees:

1) Con-Focal Deposition Uniformity: +/- 2.5% over 3" diameter wafer with 5mm edge exclusion with RF deposited SiO2 or reactively deposited TiN (measured optically with vendor'sellipsometer).
2) Vendor must have in-house ellipsometry monitor to prove deposition uniformity at time of acceptance testing
3) Base Vacuum: Better than or equal to 3.5 x 10-8Torr. Alternatives for better vacuum (9 x 10-9Torr or better) should be provided.

P) Warranty:

1) System includes 1 year warranty, which includes all non-consumable parts of the system subjected to normal, proper usage

Q) Must include photos/documentation of the following:

1) Table top work space
2) Viewport design
3) Picture of similar sputter gun configuration to provide proof of experience. Drawings or schematics not accepted.
4) Information on backing plate design for oxide targets, to ensure good cooling and target stability.
5) Letter from RHEED manufacturer confirming successful integration of their product into similar equipment.
6) Video of load-lock system showing actuation of transfer system

7) Testing documentation on low power operation of DC and RF power supplies. Critical for ultra-thin film applications.

R) System Delivery:

1) Vendor must complete Factory Acceptance Testing (at vendor's facility) and deliver the system to IITB within 18-22 weeks.

S) On-site Commissioning:

1) Vendor must provide at least (3) days of on-site commissioning, installation, and training at customer's facility.