INDIAN INSTITUTE OF TECHNOLOGY KANPUR
Kanpur 208016, Uttar Pradesh, India
Centre for Lasers and Photonics

Enquiry no.: CELP/RV/EQP/MHR/2017/1
Enquiry date: 23/04/2018
Closing date: 17/05/2018

Sealed quotations should reach the undersigned latest by **12.00 noon on 17th May, 2018** for the following:

S.No.	Description	Quantity
1	Ion-assisted Sputtering system	One

Technical details

VACUUM CHAMBER:

The deposition chamber will be used for depositing low loss optical multilayer thin films to fabricate industry standard high-reflection mirrors and anti-reflection coatings. The chamber dimensions should be greater than 300mm x 300mm x 300mm .The sample loading and unloading and maintenance are to be done through a front hinge door. The electrical power distribution, instrumentation panels and all utilities such as water, air & nitrogen are to be located on a system frame.

- The chamber should be made of stainless steel, and electro-polished for mirror shine inside.
- All CF flanges should be for ultra - high vacuum sealing.
- Provision for three two-inch circular magnetron assembly for **ion-assisted RF magnetron sputtering.**
- The sputtering will be sputter up design with three targets at the bottom plane and substrate on upper side on heater assembly.
- Two-inch sized two glass windows to view through the plasma excited volume and two additional blank ports for future upgrades.
- Base pressure of $<2X10^{-6}$ Torr at ambient at any load.
- The chamber should have necessary ports to fixed cathode anode plates, heater supply, thermocouple, shutter fixing, vacuum pumping port etc.
- The deposition process should be carried at $< 5x10^{-3}$ mbar pressure in argon, nitrogen and /or oxygen atmosphere.
- Sputtering layout geometry must be capable of depositing dense and smooth films on 10 cm diameter substrate.

MAGNETRON SPUTTERING CATHODES:

- Three magnetron sputtering targets of 2 inch size dia. each.
- All targets to be water cooled.
- The gap between the targets and substrate should be adjustable.
- The targets could have thickness variation of 2mm to 6mm

- The magnetron cathodes will be on the bottom ~~top~~ plate of the chamber.
- The shutter mechanism will be to isolate the substrate from the target. Shape, size, speed and operation of the shutter shall prevent any deposition on the substrates before it opens and after it closes.
- Appropriate shielding to avoid cross contamination of targets from each other.

RF ION SOURCE WITH POWER SUPPY TO ASSIST SPUTTERING

- The ion gun should suitable for ion-assisted deposition for optical coating.
- Ion source must be capable of etching glass, dielectrics, semiconductor and metal
- Beam energy should be high and beam diameter should be suitable size for the 10 cm diameter substrate.
- Gas compatibility : O_2, N_2 and Ar.
- Sufficient water cooling should be providing during deposition.

OPTICAL THICKNESS MONITOR (quantity: 1)

- System should have an Optical thickness monitor with digital control to measure the real time optical thicknesses of the deposited film during deposition and capable of giving the feedback to the system to adjust the thickness.

SUBSTRATE HOLDER:

- The substrate holder should be mounted appropriately for rotation through magnet coupled with motor externally. The drive arrangement has to provide a continuous rotation up to 15 rpm. Gear driven with speed control motor should be smooth to reduce vibration and noise.
- Substrate holder should be able to accommodate four rectangle samples of size 2 cm x 2cm. simultaneously. Adapter for mounting the substrates.
- Mechanical shutters to protect the deposition on the substrate during conditioning of the target and for the termination of deposition on the substrate.
- The substrate holder temperature has to go up to a maximum of 800^o C and remain stable under sputtering conditions including high vacuum, reactive oxygen and nitrogen gases.
- PID temperature controller with display and temperature control up to 800^o C necessary.
- Phase angle thyristor based power controller to be provided.
- Bellow assembly type arrangement required between the flange and chamber for adjusting the distance between target and substrate.
- Easy mounting facility for substrate loading and removing.
- Manufacturer is free to design substrate rotation, substrate holding and substrate masking arrangement subject to the condition that absolute thickness uniformity is maintained.

VACUUM SYSTEM:

The system should include the following pumping arrangement:

One high through-put Turbo-molecular Pump;

- Ultimate pressure with backing pump <$6x10^{-8}$
- The turbo pump rotation speed of 60,000rpm
- Controller turbo and instrument controller

Roughing pump & backing pump: with a bearing shielding design to isolate the vacuum environment from all forms of lubricant, dry and hermetically sealed. Ultimate vacuum $1x10^{-2}$ mbar and $8x10^{-3}$ mbar. Nominal rotation speed 1750 rpm

VACUUM VALVES:

Roughing and backing valve

- Right and bellow shield
- Electro-pneumatically operated

High vacuum valve

- Gate valve will separate the turbo pump with process chamber and includes
- Bellow shield gate valve; Manually operated
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Chamber Vent Valve

The valve to vent the chamber should include SS bellow shield and be electro-pneumatically operated.

VACUUM GAUGES:

Cold cathode gauge for monitoring high vacuum and Pirani gauges for monitoring backing pump performance. All gauges to be CF compatible

- Gauge controller with digital display
- Pirani gauge 10^{3} to 10^{-3} mbar
- Cold cathode gauge from 10^{-3} to $5x10^{-9}$ mbar
- Capacitance gauge pressure range from 0.1 mbar to 10^{-4} mbar ,

POWER SUPPLIES:

RF POWER SUPPLY WITH AUTO MATCHING NETWORK (1 No.):

- RF power supply ≥ 300 watt with the following features
- High Efficiency
- Frequency 13.56 MHz
- Compact design
- Active front panel
- Input 220 volt 50 Hz
- **Auto matching network** to deliver extremely consistent power across a wide range of plasma load conditions. RF power selection switch for one to three ways for RF power to be provided.

GAS MANIFOLD:

- Three line gas manifold to accommodate Ar gas flow 100 SCCM , O_2 gas flow 50 SCCM and N_2 gas flow 50 SCCM.
- The pressure of the gas should be controlled and maintained constant during deposition using suitable mass flow controllers with feedback loop.
- Electronic Mass Flow Controller with digital readout. Flow increment in 0.1 sccm step.
- Each MFC calibrated to a particular gas.
- Independent controller with digital display, PID loop of MFC must have integration to system controller.
- The gas manifold mounted on Al plate with high vacuum and high pressure testing to ensure there is no leak from any points.

ADDITINAL POINTS

- Optical windows should be provided in the chamber for the source and detector modules of optical thickness monitor. The vacuum chamber should have design such that facility for in situ measurement of rate of deposition and thickness of the films by ~~both quartz crystal monitor~~ and optical thickness monitor is possible. Thickness monitors at the same horizontal plane as that of substrate.(Optional)
- The operation of the system (including pump-down process and film deposition) should be semi-automated and software-controlled with an independent LCD display panel. However, a complete manual operation should be also possible if required.
- The process control software should have all the adequate provisions to control, monitor and display all the coating processes parameters including (a) deposition source power supplies for deposition, (b) mass flow controls, (c) RF source power and ion gun parameters, (d) substrate rotation and manipulations (e) venting and (f) error logging and diagnosis (g) shutter opening and closing, etc.
- Thermocouples for chamber inner wall temperature and substrate temperature measurement.
- Emergency shutoff provision shall be available.
- Contamination shields specifically for targets which are not in use. Contamination shield to be made from very low sputter yield material. Ion beam to be adequately focused to avoid any impurity sputtering. Suitable design for easy cleaning.

CONTROL &SAFETY:

- The system to be designed for 220±10 volts, 50 Hz provision for vacuum and water interlock
- Pneumatic controls as required for shutter for magnetron source, substrate holder gas manifold.
- Main frame &Control Electronics
- Safety interlocks to be provided for all electronics instruments such as RF power supply, Mass flow controller power supply, turbo power supply, vacuum gauges, capacitance power supply, and throttle valve power supply .

- **SPARE PARTS :**

- Specify what will be provided. All O rings, copper gaskets and fuses are to be mandatorily supplied.

Installation at site required. Installation should be completed within 5 months of placing the order.

5 days of training for maintenance and basic operation/trouble-shooting of the system is expected.

IIT Kanpur will provide Custom-duty exemption documents (as applicable) for parts imported from outside India.

DOCUMENTATION:

- One set of documentation in English.
- One set of documents consist of Operation and maintenance manual including engineering drawing, electrical drawings , maintenance and trouble shootings.
- OEM manual.
- Test report of imported accessories.

Terms and conditions:
Quotations should have a validity of a minimum of 60 days.
The equipment should be provided with a warranty of 1 to 3 years. Any pricing towards extended warranty should be clearly mentioned.
All optional accessories should be separately quoted.
Quotations should be submitted in two parts – technical and financial - in two separate envelopes, clearly marked as technical/financial, and kept in one bigger sealed envelope with **enquiry number mentioned on all the envelopes**. Technical specifications along with the extent of compliance should be provided.
If required, the technically suitable bidders may be called for a technical presentation at the IIT Kanpur campus with no financial assistance.
The delivery period should be specifically stated.
For suppliers from outside India, the rate offered should be FOB (specify city) or FCA terms. IIT Kanpur has its own freight forwarder for shipping from outside India.

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