

# TECHNICAL SPECIFICATIONS FOR

## PLC-IPC Interfaced DC SPUTTERING SYSTEM

**Description:** The DC Sputtering unit will be comprised of a two numbers of 2" magnetron for Sputtering. The vacuum system consisting of turbo molecular pump and dry scroll pump together with system of valves and vacuum measuring hardware's. The system shall be compatible to clean room facility.

Details about the technical specifications are given below:

Sl. No	Items	Specifications
1	<b>Sputtering Chamber</b>	<p>(A) <b>VACUUM CHAMBER:</b></p> <ul style="list-style-type: none"> <li>➤ Box type Stainless Steel (SS) chamber, to accommodate 2" dia. magnetron in the sputter-up configuration.</li> <li>➤ Chamber size: At least 400 mm (W) X 400 mm (D) X 400 mm (H) [minimum requirement].</li> <li>➤ Chamber should have front door openings for easy access of all the chamber gadgetries.</li> <li>➤ A front opening quick access door is provided for loading &amp; unloading of the substrates.</li> <li>➤ One high vacuum compatible, toughened glass view port with a manual shutter to avoid material deposition on the view port is provided on the door.</li> <li>➤ Chamber must have removable stainless steel shields for easy cleaning.</li> <li>➤ Necessary ports required for Pumping, Sputtering sources, Gas Inlet, Valves, gauges, feedthrough.</li> <li>➤ Baking facility for the whole chamber up to 100°C (optional).</li> <li>➤ Provision for adding Load lock chamber with transfer arm as a future up gradation.</li> </ul> <p>(B) <b>MAGNETRON SOURCES</b></p> <ul style="list-style-type: none"> <li>➤ Two numbers of 2" indirectly water cooled, flexible sputter source. One High power Nd-Fe-B magnet (for deposition of magnetic materials) and one standard magnet (for deposition for non-magnetic materials), which are isolated from the water.</li> <li>➤ Easy to change target without breaking any internal seals.</li> <li>➤ User-adjustable tilt angle (<math>\pm 45^\circ</math>) with respect to the plane of the substrate.</li> <li>➤ Stainless steel cross contamination shield should be</li> </ul>

			<p>provided for avoid cross contamination from each other sources.</p> <ul style="list-style-type: none"> <li>➤ Two numbers of electro-pneumatically operated source shutters with rotary shaft seal, to cover the sputtering sources should be provided.</li> <li>➤ Water interlock protection should be provided.</li> <li>➤ Provision should be provided to add one more magnetron in future.</li> </ul>
		(C)	<p><b><u>DC POWER SUPPLIES:</u></b></p> <ul style="list-style-type: none"> <li>➤ Two numbers of 500 W (minimum requirement) DC power supply. Power supply should be "European union The Restriction of Hazardous Substances (EU RoHS)" compatible.</li> </ul>
		(E)	<p><b><u>SUBSTRATE HEATER</u></b></p> <ul style="list-style-type: none"> <li>➤ Substrate holder to handle up to 3 inch diameter substrate.</li> <li>➤ Provision for substrate heating from room temperature to 800 degree Celsius with proportional integral derivative (PID) controller.</li> <li>➤ The substrate heater should be oxygen compatible up to maximum temperature.</li> <li>➤ Temperature accuracy should be within <b>±5 Deg.C</b></li> <li>➤ Substrate holder shall have provision for substrate rotation 0-20 RPM.</li> <li>➤ The vendor should provide detailed information of the heater used to achieve the 800 Deg Temp at substrate.</li> </ul>
		(F)	<p><b><u>MASS FLOW CONTROLLER</u></b></p> <ul style="list-style-type: none"> <li>➤ One number of Mass Flow Controller (MFC) for Argon (2-100sccm), two numbers of MFCs for Oxygen and Nitrogen (0-25 sccm) with necessary accessories should be provided. Accuracy (incl. linearity) should be: standard: ±0,5% Rd plus ±0,1%FS.</li> </ul>
2	<b>Vacuum Pumping System</b>	(A)	<p><b><u>VACUUM PUMP:</u></b></p> <ul style="list-style-type: none"> <li>➤ The vacuum pumping system should consist of <b>turbo molecular pumping</b> system (having the pumping speed of <b>400 Ltrs/sec</b> or better) backed by appropriate <b>dry scroll vacuum</b> pump (displacement capacity of <b>10 m<sup>3</sup>/hr or better</b>), it should be capable of achieving <b>5 x 10<sup>-7</sup> mbar</b> pressure.</li> <li>➤ Ultimate vacuum should be better than <b>5 x 10<sup>-7</sup> mbar</b> range can be achieved in clean, at 25 °C, degassed, chamber after high vacuum valve opens and initially back filled with pure and dry Argon / Nitrogen gas.</li> </ul>

			<ul style="list-style-type: none"> <li>➤ <b><math>2 \times 10^{-6}</math> mbar</b> pressure should be achieved in less than <b>60 minutes</b>.</li> </ul>
		(C)	<p><b>HIGH VACUUM VALVE:</b></p> <ul style="list-style-type: none"> <li>➤ Automatic throttle valve to control process pressure during sputtering process.</li> </ul>
		(D)	<p><b>VACUUM VALVES:</b></p> <ul style="list-style-type: none"> <li>➤ Electro pneumatically operated right angle valves for roughing, backing process should be provided.</li> <li>➤ Electro magnetically operated Vent valve should be provided.</li> </ul>
		(E)	<p><b>SS Plumbing line &amp; Collar</b></p> <ul style="list-style-type: none"> <li>➤ SS Plumbing line with flexible hoses &amp; KF connections wherever required with necessary interlocks should be provided.</li> </ul>
		(F)	<p><b>VACUUM GAUGES:</b></p> <ul style="list-style-type: none"> <li>➤ One Active Pirani gauge head sensor for monitoring a vacuum range of <b>1000 mbar to <math>1 \times 10^{-3}</math> mbar with accuracy of 15%</b>, one number of inverted magnetron Gauges sensor for monitoring a vacuum range of <b><math>10^{-2}</math> mbar to <math>10^{-8}</math> mbar, with accuracy of 30%</b>, and <b>one Capacitance Manometer</b> for measurement and control of process pressure within <b>+/- 0.1 mbar from the set process pressure</b>.</li> </ul>
3	<b>Control Console &amp; Instrumentation</b>	(A)	<ul style="list-style-type: none"> <li>➤ A standalone 19" Industrial standard control console to house all the displays of industrial personal computer (IPC), Power Supplies, Substrate heater, Substrate rotation, MFC controller, vacuum gauges, dry scroll pump, turbo molecular pump, etc.</li> <li>➤ It should have graphical user interface to retrieve and enter data.</li> </ul>
4	<b>Mounting Frame / Support Stand</b>	(A)	<ul style="list-style-type: none"> <li>➤ Main cabinet should be power coated and it should have front and back side door for easy servicing and maintenance.</li> <li>➤ Main cabinet should be mounted on 4 castor wheels for mobility and easy maneuverability with jack bolt for keeping in specified location.</li> </ul>
5	<b>System Control</b>	(A)	<ul style="list-style-type: none"> <li>➤ Programmable logic controller-industrial personal computer (PLC-IPC) interfaced for sputtering system (such as rotation controller of substrate, sputtering power sources, pump down sequence, vent sequence, power control, shutter control, substrate heater and any required components) by supervisory control and data acquisition (<b>SCADA</b>) for complete automatic user-friendly operation</li> </ul>

			<p>with Window based software with necessary data base management.</p> <ul style="list-style-type: none"> <li>• The PLC-PC Controller should have capability to create a error log which cannot be deleted or tampered with.</li> <li>• The system should have the capability to co-deposit 2 materials.</li> <li>• Automatic vacuum cycle to start up the system by switching on the pump and opening the relative valves subject to appropriate interlock.</li> <li>• Automatic deposition with user defined recipe. It should allow user to programme the sequence and time of deposition.</li> </ul> <p>➤ System Recipe Development And Control Features:</p> <ul style="list-style-type: none"> <li>• Configurable Data logging function, exportable to Excel/compatible software</li> <li>• User log also exportable to Excel/compatible software</li> <li>• Multilevel of password protection with user assignable access to recipes.</li> <li>• Provision for remote diagnostics and software up gradation should be offered along with the system.</li> <li>• System control by sequential operation to build up a standard recipe for Vacuum pump down control and shutters.</li> <li>• Software with the recipe programming, storage and recall facility.</li> </ul>
6	<b>Water Chiller</b>	(A)	➤ Water chiller should be provided for the whole unit with interlocks, tank, etc. Minimum capacity should be 0.5TR, 30 LTR.
7	<b>Warranty</b>	(A)	➤ <b>36 months</b> from the date of commissioning
8	<b>Eligibility Criteria (mandatory)</b>	(A)	<p>➤ Must have supplied minimum 5 nos. of similar equipments to Government labs / Govt. Institutions / Universities, etc., including any one the Indian Institute of Technology (IITs) in past 5 years.</p> <p>➤ List of Organization names with user details to be submitted along with offer where similar type supplied earlier to above said institutions / Universities / etc</p> <p>➤ Supplier will support the user with all the spares for a minimum period of 10 years.</p> <p>➤ Local Service (Chennai Based) should be available. Detail of experienced service engineer including contract detail</p>

			<p>should be provided in tender document.</p> <ul style="list-style-type: none"> <li>➤ Bidder must provide original test report, original warranty certificate and copy of invoice with the system for <b>OEM</b> for all imported items.</li> <li>➤ Bidder shall have to submit audited accounts (<b>Balance sheet profit and loss account</b>) of financial year 2014-15, 2015-16, 2016-2017, and 2017-2018. <b>Audited statement</b> must be signed and stamped by qualified chartered accounted.</li> <li>➤ <b>Income Tax return</b> for assessment year - 2015-16, 2016-17 and 2017-18.</li> <li>➤ Up to date sales tax clearance certificate.</li> <li>➤ <b>Coating Sample with uniformity and thickness measurement report should be submitted along with the bid.</b></li> <li>➤ <b>The thickness uniformity <math>\pm 5\%</math> or better for 1" substrate.</b></li> </ul>
9	<b>Deposition Demonstration</b>	(A)	<ul style="list-style-type: none"> <li>➤ Bidders, who satisfy above criteria, would be notified about live demonstration. Live demonstration should be performed within 30 days after receiving notification. Supplier must demonstrate AUTO deposition mode at their manufacturing facility: 1) Automatic vacuum cycle to start up the system by switching on the pump and opening the relative valves subject to appropriate interlock. 2) Titanium Nitride deposition for user-defined time and power on magnetrons, by reactive sputtering with Nitrogen flow of fixed standard cubic centimeters per Minute (sccm) defined by user, followed by Nickle deposition for user defined time and power. Above cycle should be repeated for user-defined number of times. Deposition should be done on Silicon substrate with substrate rotating at fixed RPM and heated to fixed temperature. All the user-defined values would be indicated at time of live demonstration. Quality of the film would be determined by measuring interface roughness and consistency in thickness of all layers. <b>Only upon successful demonstration of deposition of good quality (thickness uniformity <math>\pm 5\%</math> or better for 1" substrate) film, bidder would qualify technical bid.</b></li> </ul>
10	<b>Drawings</b>	(A)	<ul style="list-style-type: none"> <li>➤ Conceptual Drawings (exm: Schematic drawing of whole unit) and Technical brochures must be submitted along with the unit.</li> </ul>
11	<b>Utilities</b>	(A)	<ul style="list-style-type: none"> <li>➤ Details to be provided in the offer for space, power</li> </ul>

			supply, gases, etc for system operation
12	<b>Manuals</b>	(A)	➤ Operation Manual to be given after installation and acceptance of equipment
13	<b>User Training</b>	(A)	➤ Training for 2 users from IIT madras 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 units.
14	<b>Safety and Interlocks</b>	(A)	<ul style="list-style-type: none"> <li>➤ Electrical overload protection should be provided.</li> <li>➤ Mains Indication lamp should be provided.</li> <li>➤ Emergency ON/OFF Switch should be provided.</li> <li>➤ Safety panel switches to cut off source power supply, if doors open should be provided.</li> <li>➤ Vacuum switch interlocked with source power supply for avoiding switching-ON of Power sources without vacuum should be provided.</li> <li>➤ All major components should be connected through circuit breaker and contactor</li> <li>➤ All major electrical circuit should be provided with fuse.</li> </ul>
15	<b>Air compressor (Quoted optional)</b>	(A)	➤ Reciprocating type, Single Stage, 1HP Motor, 4CFM Air compressor, can be provided for the whole unit with interlocks, pressure regulator, tank, etc.
16	<b>Spares (Quoted optional) as</b>	(A)	➤ Quote for list of spares and consumables for 3 years operations, should be provided.
17	All voltages should be compatible with Indian conditions (220-240 V AC with 50 Hz) single-phase supply. Price should include installation charges.		