

**TECHNICAL BID PROFORMA**

Item Name: “Electron Beam Evaporation System with load-lock facilities

1.0	Bidder Eligibility Criteria-I (Public Procurement – Preference to Make in India)	Class I / Class II	Local Content value	Reference, Page No.
I	Only 'Class-I local suppliers' and 'Class-II local suppliers', as defined under DIPP, MoCI Order No. P-45021/2/2017-PP (BE II) dated 16 <sup>th</sup> September 2020 and other subsequent orders issued therein.			

**2.0 Bidder Eligibility Criteria - II**

S.NO	Bidder Eligibility Criteria - II	complied/not complied	Reference pg.no	Remarks if any
1	Vendor shall provide list of at least five customers (India and abroad) of similar systems along with email addresses, where the similar system has already been installed as part of the technical bid.			
2	A similar system with all features including evaporation and transfer chamber with RF plasma cleaning facility should be available in India for on-site visit/inspection			
3	Warranty Certificates from manufacturer for bought out items like Power Supplies, Vacuum Pumps with Serial Numbers will have to be provided along with system documentation.			
4	OEM should have authorized service Centre in India, functioning minimum for 10 years to provide repair, maintenance, calibration and upgradation facility (OEM should provide necessary service of operation certificate).			

**3.0 Technical specification**

S.NO	Sub-components description	complied/Not complied	Reference pg.no
1	<b>Vacuum chamber design</b>		
	•Fully RF shielded, High Grade Stainless Steel, electro-polished body, Main or Process Chamber should have water-cooled stainless steel 304 non-magnetic chamber with a front opened door.		
	•The dimensions of the chamber must match the future upgradability needs.		
	•An electrically-controlled shutter next to the substrate holder		
	•A thickness-measuring device, installed next to the substrate holder but below the shutter.		

	<ul style="list-style-type: none"> <li>•Top and bottom view ports in such ways that substrate/shutter can be seen through the top viewport and electron beam hearth can be seen through bottom viewport.</li> </ul>		
	<ul style="list-style-type: none"> <li>•At least 3Nos of spare view ports should be provided for future expansion. For example, the model offered could use one port to insert controlled amount of oxygen in the chamber through a pipe, which opens next to the substrate holder which will help to deposit a good optical quality thin-film of metals, oxide dielectrics.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Chamber shall have easily removable stainless-steel liners for protection of the inner chamber wall against deposition. An additional set should be provided with the system.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Achievable base pressure of the process chamber fitted with a load-lock should be better than <math>8 \times 10^{-8}</math> mbar &amp; Load- lock pressure of better than <math>5 \times 10^{-6}</math> mbar should be achieved in 30 minutes after initiating the automatic pumping routine.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Also, the system should have provision to upgrade to make a Linear Cluster Tool with Sputtering Systems.</li> </ul>		
	<ul style="list-style-type: none"> <li>•The entire fabrication must adhere to international Vacuum Welding Standards, electrochemically polished chamber inner surface for low out gassing rate. All the components, sub-assemblies and final unit must be leak tested using Helium Mass Spectrometer Leak Detector to Maximum allowable leak rate <math>&lt; 1 \times 10^{-9}</math> mbar Lt/sec Helium.</li> </ul>		
<b>2</b>	<b>Pumping System for Process Chamber</b>		
	<ul style="list-style-type: none"> <li>•System should have a roughing dry scroll pump from market established reputed manufacturers, minimum pumping speed: <math>10 \text{ m}^3/\text{hr.}</math>, ultimate pressure <math>\sim 7.5 \times 10^{-3}</math> mbar.</li> </ul>		
	<ul style="list-style-type: none"> <li>•All the flanges, piping connection cable, filter &amp; any accessories required, should be quoted</li> </ul>		
	<ul style="list-style-type: none"> <li>•Reputed make, Turbo molecular pump with pumping speed 400 liter/sec or better, the ultimate vacuum in the Process Chamber should be better than <math>6 \times 10^{-8}</math> mbar</li> </ul>		
	<ul style="list-style-type: none"> <li>•Should have automated and interlocked pumping system</li> </ul>		
	<ul style="list-style-type: none"> <li>•Vendor should furnish the details of the vacuum pumps, their make, pumpdown time etc., as part their technical bid</li> </ul>		
	<ul style="list-style-type: none"> <li>•Pumping system should be fully automated and should be controlled via a control module</li> </ul>		
	<ul style="list-style-type: none"> <li>•All necessary interlocks for water, vacuum, gate valve open / shut, linear probe in locked position, HT EB PSU covers, EB magnet should have status displayed.</li> </ul>		

	<ul style="list-style-type: none"> <li>•Vacuum Gauges suitable for measuring low and High Vacuum: Wide Range gauge of reputed make should be included.</li> </ul>		
<b>3</b>	<b>Electron Beam Gun</b>		
	<ul style="list-style-type: none"> <li>•One Electron Beam Gun reputed make, having cross-contamination proof 8 pockets (x 4cc (preferred)) rotatable hearth.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Programmable XY sweep control to pin point E-Beam source beam</li> </ul>		
	<ul style="list-style-type: none"> <li>•Point patterns are programmable from the remote-control display</li> </ul>		
	<ul style="list-style-type: none"> <li>•Low arcing kit for dielectric material evaporation</li> </ul>		
	<ul style="list-style-type: none"> <li>•270° beam deflection</li> </ul>		
	<ul style="list-style-type: none"> <li>•Motorized turret rotation to allow for multi-layer deposition should be offered as standard</li> </ul>		
	<ul style="list-style-type: none"> <li>•Upgrade: Automated turret rotation to allow for automated multi-layer programming and integration to the thin film controller is necessary but should be offered as upgrade</li> </ul>		
<b>4</b>	<b>EB powers supply</b>		
	<ul style="list-style-type: none"> <li>•EB powers supply, reputed make 3 kW output power adjustable 10 kV constant voltage stable beam position, better than <math>\pm 1\%</math> voltage/current regulation. Note that the specified power supply should be able to evaporate the materials most of all metals and insulating materials.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Safety interlocks for rear cover, water, vacuum and magnet. PSU should be operated via hand held control device that can be brought next to the deposition chamber and a simultaneous operation of the unit and viewing of the beam in the chamber should be possible in order that beam can be viewed at setup</li> </ul>		
<b>5</b>	<b>Substrate Shutter</b>		
	<ul style="list-style-type: none"> <li>•One pneumatically-controlled substrate shutter should be offered. There should be a provision to control &amp; activate the shutter manually, which will override the automatic control.</li> </ul>		
<b>6</b>	<b>Deposition Rate Controller</b>		
	<ul style="list-style-type: none"> <li>•Quartz Crystal Deposition Controller of reputed make, on a multi-microprocessor design, which enables rapid measurement updates with superior resolution, as well as modular architecture.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Thickness Display: 0.000 to 999.9 KA</li> </ul>		
	<ul style="list-style-type: none"> <li>•Rate Display: 0.0 to 999 A/sec</li> </ul>		
	<ul style="list-style-type: none"> <li>•Controller to interface seamlessly with HMI/PLC control system for manual/automated hand over</li> </ul>		
<b>7</b>	<b>Substrate heater and Rotation</b>		
	<ul style="list-style-type: none"> <li>•Substrate Holder capable of holding various dimensions of substrate from 10 mm dia. to 100 mm dia. disc.</li> </ul>		
	<ul style="list-style-type: none"> <li>•The system shall be delivered with 2 different substrate holders for different applications. Exact details to be agreed with the intender</li> </ul>		

	<ul style="list-style-type: none"> <li>•Changing of substrate holders shall be performed by trained operator in less than 15 minutes</li> </ul>		
	<ul style="list-style-type: none"> <li>• Rotation gear driven, speed control DC motor and rotary feedthrough with speed 3- 20 rpm. DC rotation stage to substrate platen, speed control and start/stop from HMI.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Substrate Heater, with a suitable 1000W Quartz Lamp Heater for substrate front side heating should be provided for varying substrate temperature from RT to a maximum of 500 °C with a thermocouple and proportional temperature control (PID) with accuracy of +/- 1 °C.</li> </ul>		
<b>8</b>	<b>System control and software:</b>		
	<ul style="list-style-type: none"> <li>•PLC-PC interfaced for thin film deposition system (such as thickness controller, rotation controller, evaporation sources, pump down sequence, vent sequence, power control, shutter control, substrate heater and anyrequired components) by HMI for complete automatic user-friendly operation with Window based software with necessary data base management.</li> </ul>		
	<ul style="list-style-type: none"> <li>•The software must be user-friendly for all types of processing</li> </ul>		
	<ul style="list-style-type: none"> <li>•The necessary software in the CD form should also be provided for future use</li> </ul>		
	<ul style="list-style-type: none"> <li>•Software configured such that all automated processes can be manually controlled</li> </ul>		
	<ul style="list-style-type: none"> <li>•Add Data Logging &amp; Displaying provision should be given.</li> </ul>		
	<ul style="list-style-type: none"> <li>•The Windows based software should be capable to generate &amp; display pump down curve, log data, error log on a perpetual basis.</li> </ul>		
	<ul style="list-style-type: none"> <li>•PC-based user interface: User operation is via an included PC integrated as part of the tool.</li> </ul>		
	<ul style="list-style-type: none"> <li>•The PC is equipped with the necessary software for fully automated / manual operation of the system. This software should be intuitive and powerful and includes the following key features. Backup copies of system software should be provided.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Monitoring and control of the pumping system and process chamber pressure.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Operation of deposition hardware: Power supplies, switch, rotation and Shutters, Graphical representation of system hardware states.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Live data recording, including to spreadsheet-compatible file formats</li> </ul>		
	<ul style="list-style-type: none"> <li>•System logs, including user inputs, System interlock statuses and diagnostics; remote diagnostics via Ethernet connection</li> </ul>		
	<ul style="list-style-type: none"> <li>•Multiple user access levels (e.g., administrator, supervisor and user; password protected</li> </ul>		
<b>9</b>	<b>Cabinet &amp; Operational Power supply and Safety Features</b>		
	<ul style="list-style-type: none"> <li>•The system should be fully mounted in an all-metal cabinet / rack 19inch having removable side panels and rear panels for access and maintenance.</li> </ul>		
	<ul style="list-style-type: none"> <li>•Power requirement such as voltage, Three Phase/single phase 60/50 Hz should be mentioned</li> </ul>		
	<ul style="list-style-type: none"> <li>•Earthing requirement if any should be mentioned</li> </ul>		

	•All the electronic components should be commercially off-the-shelf type		
	•Emergency Power Shutdown Switch on Front panel. Includes automated emergency shut off backing line valves and NC turbo vent valves for power out recovery situation.		
	•Safety features of the equipment should be provided with the all safety devices and interlocks		
	•The System should be automated by means of the PLC/PC interlocked with all system sub-controller		
	•Should have motorized Z-shift		
10	<p><b>Transfer chamber facility:</b></p> <ul style="list-style-type: none"> <li>• The transfer chamber should be connected to a main chamber.</li> <li>• Appropriate pumping system to reach the base vacuum of <math>\sim 5 \times 10^{-7}</math> mbar in the transfer chamber should be provided.</li> <li>• Fully automated RF plasma cleaning facility for substrates should be provided.</li> <li>• The transfer mechanism should be capable to transfer 4 inch substrate and smaller size substrates using a carrier.</li> </ul> <p>Should have motorized Z-shift.</p>		
11	<b>General requirements and support structure</b>		
	•Cleanroom compatible, ISO 5 Class 1000 standard, evaporator tool and all necessary supportive documents on cleanroom compatibility must be submitted along with the technical bid		
	•Cross-contamination proof 4cc multi-pocket (minimum, 4 pockets) electron-beam evaporation system is required for deposition of high purity, high optical quality, and high electrical quality thin-films and multilayer with controlled and constant deposition rate.		
	•The system should be capable to deposit thin films of various metals, dielectrics, and insulating materials of thicknesses from few nm to several $\mu\text{m}$ . 1.4 Substrates for/ materials underneath of thin-film.		
	•The system includes deposition chamber, dry vacuum pumps, valves and gauges, electron gun, power supplies, substrate holder with heating & rotating mechanism, shutters, instrumentation and all necessary control units.		
	• The functional requirements, specifications and details of sub-systems are as described above in this document.		
	•A thickness uniformity of $\pm 3\%$ for 200 nm-thick Ti, for 250 nm-thick SiO <sub>2</sub> , and 200 nm-thick TiO <sub>2</sub> to be demonstrated on 100 mm diameter Si substrates.		
	•The system and subsystems should have on-site upgradability with two water-cooled thermal sources a load-lock chamber which could handle 100 mm diameter substrates. The transfer mechanism should be able to transfer one 100 mm diameter or many smaller size substrates using a carrier.		
	•A load-lock chamber equipped with RF Etch Facility using appropriate RF power supply to clean the substrate/s before		

	transferring to the main chamber for depos		
<b>12</b>	<b>Auto/manual thin film deposition</b>		
	•PC interface to the PLC and PLC based vacuum controller for complete automation of vacuum pumping with fully automatic and a provision for manual control. High resolution colour touchscreen HMI with purpose-designed easy-to-use, powerful software to enable deposition in either manual or automatic (i.e., per user-defined recipes) control modes. System control via industrial-grade, high-stability PLC electronics.		
	•System should have USB and/or Ethernet connections for servicing/diagnostics and data logging/download during use from PC/laptop.		
<b>13</b>	<b>Safety interlocks</b>		
	•Water, low vacuum, high-vacuum, power supply connections and all necessary safety interlocks must be provided.		
	•An emergency stop button should be provided to maintain the process chamber under vacuum in case of emergency and should be able to revert to safe state in event of a power cut, ready for easy power restart.		
<b>14</b>	<b>Operating manual</b>		
	•Both electronic and hardcopy		
	•The documentation/manual shall include all drawings, schematics, spares parts catalogues and also sub-vendor's manuals.		
<b>15</b>	a)The system shall be installed / commissioned at customer site. The quotation shall be inclusive of all charges, if any, for installation and commissioning of the equipment by the vendor.		
	b)Extensive operation and maintenance training of two persons for one week at the customer site after the installation should be included.		
	c)Vendor to provide complete clean room compatible documentation/manuals soft copy/ hard copy for the systems.		
	d)Training at least 3 members during installation at IIT Madras		
	e) system shall conform to the Indian power supply standards, i.e. 230V ± 5%, 50Hz, Single Phase		
<b>16</b>	<b>Chiller</b>		
	A good chiller suitable for the sputter unit should be provided.		
<b>17</b>	<b>Optional Items</b> <b>All the optional items should be quoted separately.</b>		
	•One number of reputed make thickness monitor and thickness controller		
	•Ion-beam assisted gun for improving the density of thin film growth		
	•Upgrade of thermal evaporation		
	•The system and subsystems should have on-site upgradability with		
	•Film Thickness Monitor		
	•Film Thickness controller		
	•Vendor needs to confirm the suitability of the system offered to be able to upgrade these facilities on-site.		

	•Vendor needs to provide User references where such upgrades have been carried out on-site		
<b>ADDITIONAL TERMS AND CONDITIONS</b>			
<b>18</b>	<b>Warranty</b>		
	•Standard warranty for one year and extended warranty for two years as optional. (Optional warranty will not be considered for price comparison)		
	•Vendor shall commit to provide spares and support for 05 years after expiry of warranty period.		

(Note: It is mandatory for the bidders to provide the compliance statement in tabular column format along with catalogue page number (comply/not comply) for the above points with document proof as required. Failing which bidders will be technically disqualified)

**SIGNATURE OF BIDDER ALONG WITH  
SEAL OF THE COMPANY WITH DATE**