

Description	Compliance
1 SCOPE OF WORK	
<p>Vendor's scope of work shall cover supply, installation& commissioning of E-Beam Metal Deposition Equipment required for 150mm SEMI standard Silicon, GaAs, glass Wafers. The Tool shall have a loadlock system of handling and Processing of single SEMI standard 150mm silicon/GaAs/Glass wafer for MEMS and CMOS device manufacturing process. Also, the tool should have the capability to handle etched, fragile, thinned (wafer thickness 300 μm), and Double Side Polished (DSP) wafers (wafer thickness range: 300 μm -1 millimeter). The scope of work shall include the following:</p>	
<ul style="list-style-type: none"> Design, Detailed engineering, Fabrication and Supply of E-Beam Metal Deposition tool, as per the required specifications. 	
<ul style="list-style-type: none"> Supply of all support tools including chamber vacuum pumps, Chillers, electric cables etc. 	
<ul style="list-style-type: none"> Installation of the tool and Support equipment, including all utility connections. 	
<ul style="list-style-type: none"> Commissioning of the Tool and demonstration of its functionality as per the required specifications. 	
<ul style="list-style-type: none"> Training to concerned SCL personnel on Operations, Maintenance & Trouble shooting of the equipment. 	
<p>The systems shall be industry standard and confirm in all respects to high standards of engineering, design and workmanship and shall be capable of performing the operations in a safe and efficient manner as per industry codes. The equipment shall meet all SEMI regulations and must be SEMI complied.</p>	
2 ELIGIBILITY CRITERIA	
<p>a) Parties fulfilling the following requirements are eligible to participate in the tender:</p> <ol style="list-style-type: none"> I. Parties should be OEM (Original Equipment Manufacturer) having experience of minimum seven years in the manufacturing, installation and maintenance support of E-Beam metal deposition Equipment of 6" Wafers. II. Should have supplied, installed and successfully commissioned at least three (3) similar equipment to Semi-Conductor establishment (s) having 6" (or larger) wafer line during the last Seven (7) years. Vendor must submit document of the same with the technical bid of tender. 	
<p>b) OEM may submit the tender directly or through their duly authorized representative. OEM shall submit letter duly authorizing their representative to participate in the bid and the same shall be <u>submitted with the technical bid</u>. The authorization letter shall be <u>after the tender release date</u>. Purchase Order shall however be placed on to the OEM only.</p>	
<p>c) The vendor shall provide list of their installations of said equipment along with the name of the clients and year of installation.</p>	
<p>d) The MSME and Start-up must meet Eligibility criteria mentioned above.</p>	

SCOPE OF SUPPLY	
3.1	Vendor shall supply the equipment, including support parts viz. Chiller units, Vacuum pumps, etc. as per the Technical Specifications (Refer clause 7.00.00).
3.2	Vendor shall supply all the auxiliary items like interconnect matching cables for electrical connections; interconnect fittings, vacuum line etc. for support tool installations; Foundation Pads/bolts, Clamps, etc. as may be required to complete the installation and commissioning of the tool.
3.3	Vendor must supply the standard brochures for the offered tool with all details about the hardware, software and process detail to support their tool capability as per SCL RFP specifications.
	Any items not specifically mentioned in the specifications but required for safe and efficient operations of the system shall deemed to be included in the scope of supply of the vendor unless explicitly indicated in the bid by the vendor.
4 SCOPE OF INSTALLATION AND COMMISSIONING	
4.01	It will be the responsibility of the vendor to ensure proper installation & commissioning of the tool at SCL.
4.02	Vendor shall provide guidelines for preparation of installation site.
4.03	Vendor shall also supply the installation drawings giving detailed information regarding the port size & type for the utility connections. The foot print and weight of the system must be provided <u>at the time of tender quotation</u> .
4.04	All utility connections required for the operation of the tool (up to POCs) shall be provided by SCL. However all other fittings/connections between the POCs and main/support tool parts (i.e. Chillers, Pumps, Compressors and Electrical transformers etc) <u>must be provided by vendor</u> including all interconnects.
4.05	Vendor shall Commission the systems with the required process gases (to be supplied by SCL) and demonstrate the functionality of the tool supplied, at SCL site.
4.06	Vendor shall bring all necessary tools/instruments etc. that may be required for successful commissioning/ installation/ verification of the system and sub systems of the equipment.
5 TRAINING	
	During commissioning of the equipment vendor shall provide on-site hands-on training to the concerned SCL personnel (including classroom training) on Operations, Process, Maintenance, application software, related applications, trouble-shooting and Preventive Maintenance of the tool supplied. The training shall be extensive enough so that quick diagnostics of problems and remedial actions is possible at SCL. However, OEM may suggest for factory training at their site for maintenance and troubleshooting, etc in case the above scope is not

covered in on-site training at SCL.		
6 ACCEPTANCE PROCEDURE:		
6.01.00	Vendor shall demonstrate, at site (at SCL), the functionality as per the tool acceptance procedure specified in Annexure-A. Vendor shall provide best known baseline process recipes for validating the process parameters mentioned in Annexure-A. SCL shall have the option for Pre-shipment inspection at vendor's premises. the cost of the same (including air travel, lodging, boarding) will be borne by SCL. Final acceptance, however, will be done after installation and demonstration of the functionality of the equipment, as per the acceptance procedure (Annexure-A), for at least three runs each per process at SCL.	
6.02.00	Factory acceptance Test (FAT): Vendor to provide all document related to FAT before shipment of tool to SCL. Vendor should submit all standard FAT test/procedure plan documents of the same with the technical bid of tender. Vendor must perform FAT as per their standard procedures and submit the report before shipment of the tool.	
7.00.00 TECHNICAL SPECIFICATIONS		
Following are the detailed technical specifications of the required system. Vendor has to provide complete information as required in various sections for proper evaluation of the bid. Vendor has to provide clause by clause compliance. The statements in the compliance sheet shall be supported by relevant documents/brochures/published literatures, mere compliance without adequate supporting documents are liable to be rejected.		
S/N	Process requirement for E-Beam Metal deposition tool	
1.	Material to be deposited (The tool should have capability to deposit the following materials)	<ol style="list-style-type: none"> 1. Aluminium 2. Titanium 3. Gold 4. Platinum 5. Chromium 6. Zinc 7. Nickel 8. Germanium 9. Indium 10. MgF₂ 11. ZnS <p>Note: We have requirement of Deposition for all above 11 no of material through Metal deposition tool. However number of pockets/crucible required in the tool can be 4 or more (for E-Beam) to cater multi-layer deposition. The materials sr. no 1 -8 must be deposited by E-Beam source.</p>

2.	Deposition thickness	Up to 1 µm (single layer) without breaking the vacuum in deposition chamber.	
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4.	Deposition Stack requirements	Up to 4 layers (E-Beam source) Up to 2 layers (Thermal source)	
5.	Deposition setup type	Non Conformal (Liftoff) Note: However the tool must have option to upgrade to conformal (angular) deposition with procurement of Upgradation kit (at future stage).	
6.	Heating Source	1. E-Beam : 1 nos 2. Thermal Evaporation(Resistive Heating): 2nos	
7.	Tool performance	Should have a load lock with single wafer transport arrangement.	
8.00.00 SYSTEM REQUIREMENTS			
8.1	E-Beam Source	<ul style="list-style-type: none"> a. The tool should have E-Beam source (Telemark/ Ferrotech/Ulvac make) capable for handling 6k Watt of power or higher. b. Should have capability/provision for deflection of electron beam in x and y direction in the crucible by manual and automatic mode. c. The E-Beam source assembly should be complete with all necessary feed through and shutter assembly. d. Vendor shall provide 4 sets of E-Beam gun assembly as spare. 	
8.2	Thermal Source and Power Supply	<ul style="list-style-type: none"> a. Complete two (2) set of Thermal source (Resistive heating) assembly mounted next to the electron beam source to be controlled automatically as well as manually. b. Must include separate shutter assembly and electrical transformer for Thermal source apart from E-Beam source. c. Must include suitable Solid State Power supply with an auto switch to change the power supply for one thermal source to another. d. Must include current regulator with display of current in the controller as well as in the computer. e. Must supply suitable thermal evaporation boat for each material. 	

8.3	Process Chamber	<ul style="list-style-type: none"> a. The process chamber must be made of stainless steel of thickness 15mm or more. b. Must have provision of water-cooled chamber wall welded (arc welding) on the all periphery of process chamber. c. It should have hinged front door with viewport assembly for viewing crucible and wafer during deposition. d. The chamber should be clean room class-100 compatible or better. e. The chamber should have leak proof for 2×10^{-7} Torr ultimate base vacuum (with clean, dry and empty chamber). f. The process chamber must mount on all steel frames with safety panels. g. The process chambers should have single wafer process capability. h. Tool should have inner chamber shield/liner (made of Stainless Steel). Vendor to supply extra one set of shield as spare. 	
8.4	Chamber Wafer Fixture	<ul style="list-style-type: none"> a. Should have substrate holder which can hold one 6" wafer at a time with wafer type mentioned in the acceptance procedure. b. The wafer holder should have rotation mechanism for rotation in the chamber during deposition with variable speed drive motor. (Speed control must be from the recipe of the process) 	
8.5	Pumping System Process Chamber :	<ul style="list-style-type: none"> a. The vacuum system in process chamber must have one 8" Cryogenic Pump (CTI/ Edwards/Leybold make) with water cooled compressor OR Turbo Molecular Pump (Leybold/ Varian/ Edwards/ Pfeiffer make). b. Must consist of suitable mechanical backing Vacuum Pump (ANESTA-IAWATA,/Leybold/Varian /Pfeiffer / Edwards make). c. Separate backing pumping systems should be provided for process chamber and load lock. d. Ultimate Vacuum in process chambers shall be <u>less than 2.5×10^{-7} Torr</u>. However, pumping time for reaching from atmosphere to 1×10^{-6} Torr within 3 hours or less. e. The regeneration for Cryo Pump must be done automatically from the software. f. Suitable vacuum gauges for 	

		<p>measuring the pressure of chamber, pump line must be provided.</p> <p>g. The pumping and electrical lines connected between process chamber and pumps must be supplied.</p>	
8.6	Load lock	<p>a. Load lock must capable of loading and un-loading single substrate of SEMI standard 6" diameter substrate in to/from process chamber using suitable mechanism.</p> <p>b. Load-lock should have isolation valves (for Chamber and Turbo Molecular Pump), roughing valve and vacuum gauges.</p> <p>c. The pumping mechanism must have turbo molecular pump with mechanical backing pump.</p>	
8.7	Pumping System Load Lock :	<p>a. The vacuum system in Load Lock chamber must have Turbo Molecular Pump (TMP) (Leybold/ Varian/ Edwards/ Pfeiffer make).</p> <p>b. Must consisting of mechanical backing Vacuum Pump (make ANESTA-IAWATA,/Leybold/Varian /Pfeiffer / Edwards) connected for TMP.</p> <p>c. The tool should have individual pumping systems (Pumps and vacuum line) for deposition chamber and load-lock.</p> <p>d. The ON/OFF control of TMP and backing pump must be controlled from the software of the tool.</p> <p>e. The load lock system should be integrated with the process chamber so that during wafer transport the pressure inside the process chamber must be higher than that in the load lock, in order to avoid any contamination leakage.</p> <p>f. The ultimate Vacuum inside Load-lock shall be less than 2×10^{-7} Torr. However, the pump down time of the load lock from atmosphere to vacuum (i.e. 2×10^{-7} Torr) must be 30 minutes or less and vice versa.</p> <p>g. Also the pumping and electrical lines connected between Load-lock and pumps must be supplied by vendor.</p> <p>h. Suitable vacuum gauges for measuring the pressure of Load-Lock, pump line etc. must be provided.</p>	

8.8	Crucible Indexer and Control (E-Beam source)	<ul style="list-style-type: none"> a. Should have minimum 4 numbers of crucibles/pockets for putting the deposition materials. b. The setup should have motorised turret in which the pockets can be selected both through software and deposition controller. Addition to this, the selection of pockets must also be controlled from the recipe of the process. c. Vendor to provide compatible crucible liners (Two set for each materials) for storing the deposition materials. 	
8.9	High Voltage power supply and Power Supply Controller	<ul style="list-style-type: none"> a. The power supply (Telemark/ Ferotec make) for E-Beam should have following specifications: Power: 6kW or higher Voltage: 8 k Volt or higher. Type : Solid State Power Supply (non-Tetrode tube based) b. The power supply should be integrated with power controller and filament transformer. c. Must have digital XY sweep controller (Telemark/ Ferotec make) to control the position of E-beam in the crucible through software as well as through manual control. d. The deflection of electron beam must be provided with angle 270°. 	
8.10	Deposition Controller	<ul style="list-style-type: none"> a. Deposition controller should have programmable process controller (Telemark , Ferrotech, Infinicon make) with dual crystal sensor. b. Deposition controller should be able to control the deposition rate for the E-Beam as well as thermal evaporation sources using respective power supply. c. The deposition rate sensor must be water cooled Quartz-crystal and oscillator based. d. The deposition monitor, should have following display features : Thickness Display range: 0.001 to 999.9 kÅ Deposition rate Display : 0.0 to 999 Å/sec e. The dual crystal sensor must be provided with shutter for selecting/masking either one sensor. f. Vendor to provide at least 30 no of crystal sensors as spare. 	
8.11	PC access control:	<ul style="list-style-type: none"> a. The tool should have PC control for 	

		<p>centralized control of all the modules of the tool. i.e. all the processing condition like temperature, vacuum, accessories (Pumps, E-Beam/Thermal Power supply etc.) must be able to control the above processing condition from the recipe of the software. Also display all the deposition parameters like deposition rate, power and interlock etc during deposition.</p> <p>b. The display of the computer should have touch screen capability.</p> <p>c. Perpetual ownership of the equipment software(s) must be given to SCL, including permanent license key during final acceptance of the tool.</p>	
9.0	RECOMMENDED SPARES AND CONSUMABLES	<p>Vendor to provide itemized Quote (for reference) for recommended essential spares and consumables which may be required for meeting the essential stated tool uptime > 90%. This quotation for the spares shall not be considered for tender evaluation and is for reference only.</p>	
10.0	SAFETY	<p>a. Appropriate safety mechanism in terms of alarms and EMO shall be provided for operator safety. Vendor to provide the details.</p> <p>b. The system shall be design to be compliant with CE standards or other Industrial safety standard.</p> <p>c. Fitted with all necessary safety interlocks (Hardware and software) for safe operation.</p> <p>d. Must be fitted with interlock at least for (i) water flow, (ii) pneumatic pressure ,(iii) tool outer panel, (iv)High voltage module panel inter lock, (v) earthing leakage, (vi) substrate rotation , (vii) pocket select, (viii) vacuum (ix) Arcing etc</p>	
11.0	WARRANTY	<p>Vendor to provide a comprehensive part and labour warranty for a period of 24 months after acceptance of the system at SCL. Vendor to guarantee 90% production uptime for the equipment based on 24 hours working, 7 days a week. Vendor to give two Preventive Maintenance Visits in the Warranty Period of the tool. Vendor to provide all consumables, spares and PM Kits which will be required during preventive maintenance during the period of</p>	

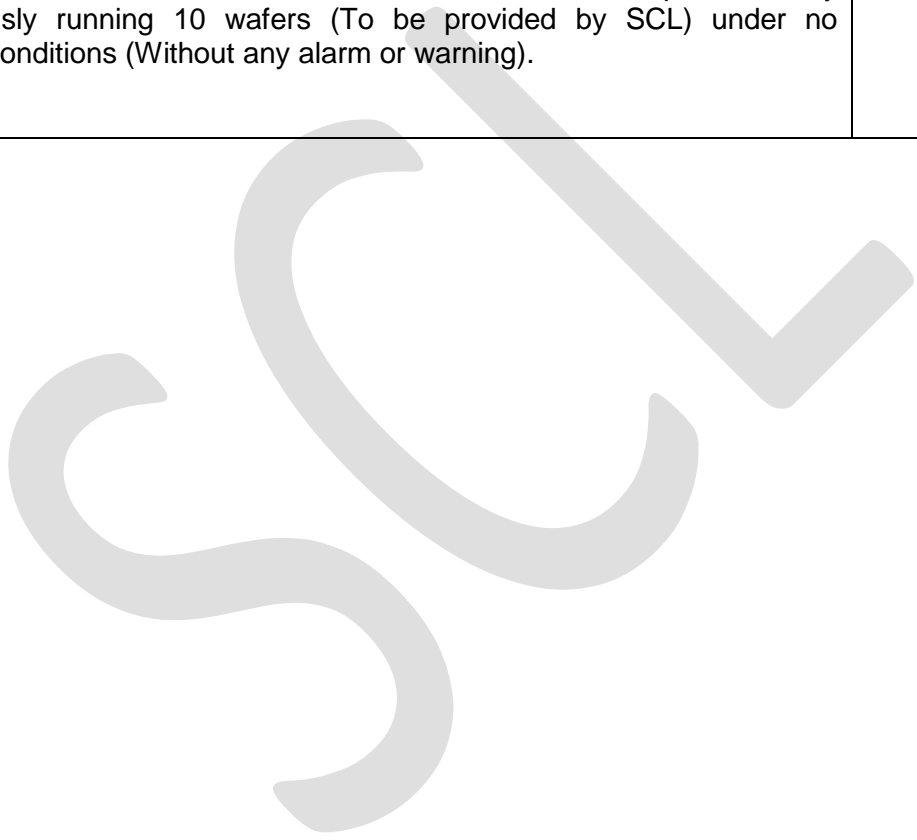
		warranty. Any breakdown occurred during the warranty period should be addressed within 72 hours.	
12.0	POST WARRANTY SYSTEM SUPPORT:	Spares and maintenance support required for 7 years after the expiry of warranty period. Vendor to quote for Post-warranty 'labor-only' AMC charges per year for a period of 3 years (<u>AMC cost in % of tool cost with the technical bid</u>). This quotation shall not be considered for tender evaluation and is for reference only.	
13.0	TECHNICAL DOCUMENTATION	Vendor to supply two sets of technical documentation (in English language) containing, but not limited to, the following: <ul style="list-style-type: none"> a. System user manuals (two sets of clean room and two sets for grey rooms). b. System Hardware / Software manuals c. Maintenance /Diagnostic / Trouble shooting manuals including schematics, Circuit diagram (Electrical & Plumbing) along with Parts for all spares. d. OEM system/subsystem/accessories manuals e. Vendor shall supply all additional information such as application development notes, paper published/process information etc. related to the system. 	

Description				Compliance
<u>Annex A: Acceptance Procedure</u>				
Equipment will be accepted at SCL on the basis of following process parameters / test procedures.				
<u>Process Requirements/ Guarantees for Deposition processes</u>				
S/N	Process Matrix	Specification	Remark	
1.	Substrate Handling	SSP,DSP Silicon wafer, Thin wafer (300µm), Fragile wafer, GaAs wafer and Glass wafers.	SSP: Single side Polished DSP :Double Side Polished	
2.	Pump out time Main Chamber	Pumping time for reaching from atmosphere to 1×10^{-6} Torr : 3 hours or less.		
3.	Pumping/Venting time Load Lock	The pump down time from atmosphere to vacuum (i.e. 2×10^{-7} Torr) : 30 minutes or less and vice versa.		
4.	Dep. rate required	<ul style="list-style-type: none"> • 5 Å/sec or higher (E-Beam) • 10 Å/sec or higher (Thermal source) 		
5.	Deposition thickness and non-uniformity (within wafer)	1 µm ±5%	The said thickness must be demonstrated for any three materials out of 11 of SCL choice. The thickness will be verified from SEM analysis.	
6.		100 Å ±5%		
7.	Non-Uniformity (wafer to wafer)	< ±5%	Non-uniformity Formula = $\{[(T_{max} - T_{min}) / T_{avg}] / 2\} \times 100\%$.	
8.	Deposition Time (max) for 1µm Gold deposition through E-Beam	35 minutes	Deposition time excluding wafer transfer and pump down time.	
9.	Material Consumption from crucible for 1 µm Gold deposition on a single substrate by E-Beam source	5 grams or less		

10.	No of wafers of deposition of thickness 1 μm (any one material out of 11 no of specified materials) without topping the material in crucible (through E-Beam source).	5 nos. of wafers or higher		
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NOTE:

1. Vendor to provide information on the number of wafers required for setting up the tool as per above acceptance procedure. Whereas wafers required for Factory Acceptance Test (FAT), vendor has to use their own wafers.
2. Process recipes should be demonstrated with proper set point and end point detection.
3. Vendor shall demonstrate the substrate transfer capabilities by continuously running 10 wafers (To be provided by SCL) under no process conditions (Without any alarm or warning).



Annex B: UTILITY REQUIREMENTS FOR TOOL					
S. No.	UTILITY	SPECIFICATIONS			END/ FINAL ONNECTION DETAILS (For Tool Hook-up)
		FLOW (SLPM/ SCCM)	PRESSURE	OTHERS (PURITY / TEMP.)	
1	Environmental Conditions - Clean Room Class - Temp. - RH				
	UHP Water. <i>(Please specify Hot Water reqmt., if any)</i>				
3	BULK Gases - Process Nitrogen - General Nitrogen - Oxygen - Hydrogen - Argon - Helium				
4	Specialty Process Gases (Pl. specify reqmt for all the process gases)				
5	Process Cooling Water				
6	Compressed Dry Air				
7	Process Vacuum				
8	Exhaust - Acid Exhaust - Solvent Exhaust - General Exhaust				
9	Drains for - Acid/ Alkalies - Organic Solvent - CMP etc			# # #	
10	City Water				
11	Special Flooring/ Foundation reqmts, if any (Anti Vibration pads etc.)				
12	Vacuum Wands/ N ₂ guns.				
13	Dimensions/Foot-Print & Weight. - Tool Foot-Print. - Tool weight - Support Tools.				
14	Electrical Supply (50 Hz) - Normal Supply. - UPS - Emergency back-up	(Load)	(Voltage)	(phase)	

Vendor to strike off whatever is not applicable and specify any other utility requirements.

** Specify Impurity levels in ppm /ppb.*

please mentions composition of effluent, if discharged from the Tool.

NOTE: Power Mode Available at SCL: 230V +/- 10%, 1 PHASE, 50Hz +/- 5% OR 415V +/- 10%/3 PHASE, 50 Hz +/- 5%.