Request for Proposal

Microwave Plasma system

March 2024

Government of India

Indian Space Research Organization

Space Applications Centre

Ahmedabad-380015

INDIA

Microwave Plasma system

Sr No	Specifications	Requirements	SAC Remarks	Vendor's Remarks
1.	**System Applications**			
1.1	System Applications	This proposal is for supply, installation, commissioning and demonstration of Microwave Plasma Cleaning System suitable for **Compound Semiconductor fab** line.		
		System should be capable of improving metal to semiconductor adhesion through **descum process**. System should also be compatible for conventional **surface activation, resist stripping** (including negative photoresist), **residual removal, organic and inorganic contamination removal, plasma cleaning** and **ashing** applications.		
		A typical Plasma Cleaning System shall consist of control system, vacuum chamber, gas supply, pressure gauge, Microwave Plasma generator (2.45GHz), vacuum pump.	The detailed specifications of individual modules appear below.	
2.	**Technical Specification**			
2.1	Sample size	Substrate/Wafer size: Up to 4" x 4" square and 6" dia circular. Substrate thickness: Up to 1.5 mm System should have manual loading/unloading mechanism. Suitable substrate holders for wafers and devices shall be provided. Dimensional drawing to be provided along with the quote.		
2.2	Wafer horizontal loading mechanism	System should have up to 6 inch diameter wafer horizontal holding/mounting mechanism with substrate heating/cooling.		
2.3	Wafer vertical loading mechanism	System should have quartz boat/tray based holding mechanism to accommodate vertical mounted multiples wafers/substrates/devices.	Number of substrates/wafers/devices of different sizes can be hold vertically at a time shall be clearly mentioned.	
2.4	Substrate temperature for horizontal mounting mechanism	System should have suitable substrate/wafer heating and control mechanism only for horizontal mounting wafer loading. Temperature range: RT-250 °C Accuracy: ± 5 °C Uniformity over 6" wafer: ± 10%		
2.5	Substrate cooling during process for horizontal mounting mechanism	System should have recirculation water cooling mechanism during process only for horizontal mounting wafer loading. Temperature range: 5-25°C ± 1°C Recirculation water chiller should be quoted as a mandatary requirement.		
2.6	Vacuum Chamber	Chamber Material: Quartz glass/ Aluminium/ Stainless steel Chamber Volume: 15-20 lit Chamber should have front loading mechanism.		

		View port: Minimum 4" dia quartz window view port with UV- and microwave shield for protection.	Exact view port size to be mentioned.	
		Chamber O-rings should be compatible for corrosive gases.		
2.7	Vacuum System	System should be equipped with vacuum pump. Vacuum pump should be from renowned suppliers like Pfeiffer/Edward/Leybold. In case of water cooled pump, supplier shall include the quote for recirculation water chiller as a mandatory requirement. catering following capabilities: Ultimate vacuum : <0.10 mbar Pump down time should be < 30 minutes Plasma operating pressure: 0.6-1.5 mbar Dry Pump with working capability : 24x7 The pump shall work for corrosive gases too		
		Required automatic vent valve, filter and other essentials accessories including maintenance bearings of vacuum pump should be provided.		
2.8	Vacuum plumbing and valves	All the valves are electromagnetic/ electro pneumatically operated. It shall provide vibration free operation and easy access for maintenance and leak tests. One set of valves should be included as a spare.		
2.9	Pressure gauges	Pressure gauges: Pirani sensor or capacitance manometer with display range10^{-2}-10 mbar. Universal type with digital display computer interface capability. It will be essential to provide NIST traceable calibration certificates at the time of supply, valid for a period of one year from final installation at SAC. One extra set of pressure gauges should be included as a spare.	Maintenance and calibration procedures are to be specified by supplier.	
2.10	Vacuum and Status display	Digital display for chamber vacuum level, diagnostics etc., shall be provided. System should be capable of online monitoring of operating and process parameters and display at least following parameters: Vacuum level Process pressure Power Temperature Gas flow rates Process time	Necessary alarms to be provided when the process parameters are out of range.	
2.11	Plasma Generator	Frequency: 2.45 GHz		
		Power: up to 1000 W. Plasma generator should be continuously adjustable or with step size of 1W.		
2.12	Gas Channels	System should be equipped with 4 gas channels (O_2, N_2, Ar, CF_4).		
		Separate MFCs and valve system for each gas inlets should be provided. MFCs should be from renowned suppliers like Brooks, MKS. MFC range: 0-200 SCCM Flow tolerance: < 5%		

		Calibration mechanism of MFC and gas correction factor for different gases should be provided.		
		All the gases can be purged individually as well as simultaneously.		
		A calibrated pressure monitor and display should be provided for each gases (Ar, N_2, O_2 and CF_4)		
2.13	Control System	Controlled and operated through PLC/PC with suitable high resolution display. At least 100 automatic programs shall be stored with sub programs. The process data shall be saved as readable files and there should be real time monitoring of process data. Online pressure control by PI/PID.	PLC automation of GE/Siemens or equivalent is preferable with all essential programmable, operation and safety interlocks.	
		The set point and actual value of the mass flow controller shall be indicated and controlled.		
		A desk top PC should be provided for all operations of the system with minimum CORE-i7 or higher processor, >3 TB HDD, >64GB DDR RAM, LCD/LED/TFT Monitor, Latest version licensed Windows operating system. System should have provision for remote access and USB connectivity ports.		
2.14	Process Control and monitoring	PC based semi-automatic with full function manual over ride for diagnostics and maintenance purpose is essential.		
2.15	Interlocks	Vendor shall clearly bring out and include necessary interlocks which are essential for safe & secure operation. Vendor shall also provide detailed list of all built-in safety features including power failure and other emergencies. The System should have adequate safety interlocks including Emergency OFF switch equipped with manual key opening. All the necessary safety features and interlocks to guaranty system safety, personal safety like parasitic plasma shield, high voltage protection, door control, etc. to be provided.	Interlocks required for system operation, process and human safety	
2.16	Faraday Box	System should be equipped with faraday box for electrical sensitive parts.		
3.	**System Evaluation, Factory acceptance, Installation, Performance demonstration, Training and System acceptance**			
3.1	System Evaluation Test	Post opening of technical bids, SAC shall provide samples to all technically compliant suppliers for plasma process capability demonstration (as per Annexure-I). These suppliers would be required to collect the samples from SAC and carry out plasma processing as per Annexure-I, using the proposed Microwave plasma System, without any charge. The samples should be collected within 10 working days of receipt of intimation, for sample collection, from SAC.		

		The processed sample, along with relevant characterization test reports, shall be supplied back to SAC within 60 days of receipt of samples.		
		Price bid will be opened only for those vendors whose processed samples meet SAC requirements.		
3.2	Factory Acceptance Teat (FAT)	During FAT, performance checks (as per Annexure-I), on SAC supplied samples has to be demonstrated. SAC engineers shall participate in FAT, remotely, through a live video connection.		
3.3	Installation of system	System should be installed by OEM or their qualified representatives at SAC.		
3.4	On-site Performance demonstration	On-site performance demonstration (as per Annexure-I) shall be carried out by OEM or their qualified representatives at SAC.		
3.5	On-site training	Supplier should provide necessary operational, maintenance and application training by OEM or their qualified representatives to SAC engineers/ technicians		
3.6	System acceptance	System shall be accepted only after successful performance demonstration and training, as above.		
4.	**Essential spares & Warranty period**			
4.1	Essential spares & consumables	The essential standard spares should be provided for 2 years of usage.		
4.2	Spares/consumables support	Supplier to guarantee spares/consumables support for a period of minimum 10 years.		
4.3	Standard Warranty	The system should have on-site standard warranty of 1 year. The warranty should be effective from the date of system acceptance at SAC.		
4.4	Extended warranty	The system should have on-site extended warranty of 2 years beyond the standard warranty period of 1 year. Payment against extended warranty shall be released on pro-rata basis at the end of each extended warranty year.		
5.	**General Specifications**			
5.1	System size, foot print and weight	System should be compact in size, weight and lowest possible foot print. System should be maintenance friendly. Details to be provided for overall dimension, size and weight.		
5.2	Mains power supply	230 V ± 10 % single phase (1φ) OR 440 V ±10 % three phase (3φ) 50 Hz Exact electric load and heat dissipation for full operation to be specified		
5.3	Environmental conditions & site requirements	The quoted system shall be fully compatible to clean room with 22+/- 2 ^{0} C and 55 +/- 5 % RH environmental condition. Exact details for operating conditions and detailed site requirements are to be specified.		
5.4	Utilities	All utilities which are essential for smooth and continuous operation of the system should be quoted as a mandatary requirement.		

5.5	Operation and trouble-shooting manuals along with electric/mechanical schematics	The system should have 2 sets of manual in English in hard and soft copy format. This manual should cover detailed electrical/mechanical schematic diagrams, operation and troubleshooting.		
5.6	Maintenance Tool Kit	Maintenance tool kit should be provided by the supplier. Cost of kit shall be provided with quote.		
5.7	Safety	System design shall take care of all safety aspects like equipment, human and application safety. Supplier should provide full details about inbuilt safety aspects. Viewing window of the system should be provided with UV and microwave protection. The system should comply with international safety standards.		
5.8	System heritage	The complete system or parts like plasma generator, vacuum pump etc. shall be from reputed manufacturer/ supplier and have a proven heritage and necessary details shall be submitted in support of this. Offered model no. to be mentioned clearly. Refurbished system is not acceptable. Prototype, developmental or refurbished system shall not be quoted. A detailed list of existing customer base, references, and contact details may be submitted along with the quotation.		
5.9	Compliance	Supplier shall prepare detailed compliance statement with reference to all the specifications/conditions/sub points of this tender document clearly indicating quantitative values offered wherever applicable. Manufacturer/vendor shall provide point by point compliance to each specification, clearly indicating compliance or non compliance of each specification point along with their offer. No indication of compliance/non-compliance will be considered as non-compliance.	Supplier shall also bring out the reasons for deviations, all relevant standards or with better specifications along with explanations.	
5.10	User list	User list of plasma cleaning system supplied in last 5 years to be provided.		

ANNEXURE-I

1. **Inspection & Checking of the System:**
   1.1. Inspection and checking of basic configuration including structure, chamber, plasma source, power supply unit, material of construction etc.
   1.2. All the relevant documents like data sheets, manuals, test reports including documents and warranty certificates of third party OEM items shall be shown by supplier
2. **Functionality checking & specification demonstration:**
   2.1. Functionality for all the subsystems like plasma source, vacuum pumping system, vacuum level, power supply & control system, wafer loading as well as various mechanical modules should demonstrated by the supplier.
   2.2. Achievement of vacuum level of <0.1 mbar within 30 minute, Plasma operating pressure: 0.6-1.5 mbar, plasma power up to 1000 Watt, wafer/substrate heating upto 250°C ± 5°C, etc. should be demonstrated by the supplier
3. **Plasma process capability demonstration on SAC supplied samples:**

<table>
<tr><td colspan="2">Sample: 1 PMMA/HSQ/AR-P resist pattern generated by electron beam lithography (CD: 50-250 nm line-gap) on Quartz, GaN, Silicon wafer; size: up to 6” dia</td></tr>
<tr><td>Process: Descum and lift-off</td><td>• Descum process demonstration without deforming resist profile
• Lift-off demonstration (electron beam evaporation shall be done using SAC facility)</td></tr>
<tr><td>Process: resist striping and residual removal</td><td>• Resist stripping (positive and negative photo resist) demonstration on metallized pattern substrate.
• Residual removal demonstration on metallized pattern substrate</td></tr>
<tr><td colspan="2">Sample: 2 AZ 4620 resist pattern generated by laser lithography (CD: 2-5 µm line-gap) on Quartz, Alumina, GaN, Silicon wafer; size: up to 6” dia</td></tr>
<tr><td>Process: Descum and lift-off</td><td>• Descum process demonstration without deforming resist profile
• Lift-off demonstration (electron beam evaporation shall be done using SAC facility)</td></tr>
<tr><td>Process: resist striping and residual removal</td><td>• Resist stripping (positive and negative photo resist) demonstration on metallized pattern substrate.
• Residual removal demonstration on metallized pattern substrate</td></tr>
<tr><td colspan="2">Sample: 3 LOR/PPR/SU-8 resist pattern generated by mask based optical lithography (CD: 2-5 µm line-gap) on Quartz, Alumina, GaN, Silicon wafer; size: up to 6” dia</td></tr>
<tr><td>Process: Descum and lift-off</td><td>• Descum process demonstration without deforming resist profile
• Lift-off demonstration (electron beam evaporation shall be done using SAC facility)</td></tr>
<tr><td>Process: resist striping and residual removal</td><td>• Resist stripping (positive and negative photo resist) demonstration on metallized pattern substrate.
• Residual removal demonstration on metallized pattern substrate</td></tr>
</table>