Request for Quote and Specifications of ICP-RIE SiN etching tool in GaN process development

- The GEECI (Gallium Nitride Ecosystem Enabling Centre and Incubator) at SID-Indian Institute of Science is seeking bids from qualified industries for a set of 6 plasma based tools. Specifications for one of them an ICP RIE SiN etching tool is listed below.
- The commercial bid should include both the cost of this individual tool and the reduction in cost if the entire set were to be bought from a single vendor.
- Companies need to submit two bids, a technical bid and a commercial bid, in **two separate** sealed envelopes. The bids should be submitted no later than 30 days from the date of posting of this tender, as listed on the website date/time stamp, and by 5 pm on the 30th day or next weekday in case the 30th day falls on a weekend or a national holiday.
- Both technical and commercial bids should be addressed to "The Chief Executive, SID, IISc, Bangalore 560012, GST # 29AAATS5333E1ZJ."
- All quotations should be CIF Bangalore.
- Cost of last mile transportation, including any insurance, from port of shipment to IISc has to be quoted as an option.
- In case of courier shipments maximum permissible weight would be 70kgs.
- The envelopes should be addressed to "Prof. Srinivasan Raghavan, CeNSE, IISc, Bangalore, 560012" and submitted to the office at CeNSE, IISc in Room No. GF 15 between 9 am and 5 pm.
- All questions regarding this tender should be addressed to Prof. Srinivasan Raghavan at the email address sraghavan@iisc.ac.in
- Post such submission all vendors should send an email to sraghavan@iisc.ac.in with the subject line: "GEECI_Bidder's name_Tool Name" to intimate him of the submission within one day.
- Deviations from the technical specifications requested are allowed. Such deviations must be highlighted and justified. Their acceptance or rejection will be left to the discretion of the technical committee.
- The equipment sought will be placed at the Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science (IISc). IISc is India's No. 1 institution on higher learning and the Center for Nano Science and Engineering is home to one of the best academic fabs in the world.
- The technical response, corresponding to the tool being offered, should be in the form of a compliance table with at least 5 columns. Serial number in column 1. Each of the row wise items below should be addressed in a separate row of the table in column 2. Compliance to this requirement, in Yes/No, deviation from it and justification should be provided in the neighboring columns 3-5. Post the opening of a hard copy of the technical bid the committee will request for a soft copy of the files for further processing. Companies should **NOT** mail soft copies of the files unless specifically requested for.
- Detailed technical specifications of the tool being offered should be included.
- Any additional capabilities or technical details, that you would like to bring to the attention of the purchase committee, can be listed at the end of the technical table.
- If multiple systems can fulfill the requirements, vendors can submit multiple bids.
- Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
- The commercial bid should be broken up to the maximum extent possible into separate items with a cost against each to enable better comparison of price for various configurations across the bidders. As an option, please provide itemized cost for any *suggested* accessories/add-ons that may enhance the

usability, capability, accuracy or reliability of the tool. Vendors are encouraged to quote for as many add-ons as their tool portfolio permits.

I.	**ICP-RIE SiN Etcher**	
1.	Primary application	• ICP-RIE for etch specify materials: SiN and SiO2. • The tool should be designed for pilot-line production environment. • In suite resist/polymer removal. • Must conform to some SEMI standard for ICP equipment manufacturing, e.g. SEMI E6-0914, SEMI E15-0698E2 , SEMI S21-1106E , SEMI S19-0311 (Reapproved 0816), etc.
2.	Secondary application	• Shallow etches of SiO2 (<100 nm)
3.	Process capability	• SiN etch with a etch non-uniformity of <5% within a 150 mm wafer and <3% wafer-to-wafer, with an excess surface roughness <1 nm. Etch rate <100 nm/min. • SiO2 etch with a etch non-uniformity better than <5% within a 150 mm. wafer and <3% wafer-to-wafer, with landing excess surface roughness <1 nm. Etch rate <100 nm/min. • High selectivity to GaN, AlGaN, and Metal as stop layer. • Etching capability down to less than 100 nm feature size. • Anisotropic etch profile better than 80 deg. • Please specify the highest aspect ratio that can be achieved. • Provide detailed technical literature for the system use, such as your prior experience and technical data on etch processes and tool capabilities.
4.	Process recipes	• At the time of installation, all standard process recipes should be provided.
5.	Substrate details	• Processing of upto 6-inch wafers. • However, we need suitable substrate adapters to process 4-inch, 3-inch, 2 inch and cut pieces of substrates measuring more than 2cmx2cm. • Should be able to handle substrates other than Si such as, Sapphire, Alumina, and SiC. • Should be able to handle wafer bow ~50 micrometer.
6.	Tool requirements	• Load lock chamber: software controlled load and unload options. • Vacuum loadlock with small volume < 6 liter. • Inter-chamber valve: VAT MonoVAT. • Suitable independent dry pump. • Software controlled transfer on starting a process request from the PC, the wafer should be automatically loaded for processing and returned to the loadlock and left under vacuum until the user is ready to retrieve it. Then manually the loadlock vented and lid opened for unloading of the wafer. • The roughing vacuum pump for main chamber and load lock chamber

		should be dry pumps (preferably Edwards) with appropriate pumping capacity. Turbomolecular pump with appropriate capacity for ensuring the required process vacuum. • He substrate cooling. • Process Chamber with chamber made from a full block of Aluminium. No sealing or welding inside the process chamber. • Pumping flange and tee >= 100 mm for very high effective pumping speed • Front >=40 mm flange with viewport + side port for OES • The system design of the plasma source and pumping must be radially symmetric to ensure best uniformity over a wide parameter range. • The system should be fully interlocked to protect the system hardware from any service failure (e.g. failed water supply for cooling purposes) and to protect the operator from electrical shock during maintenance procedures. • Option to electrical heat chamber up to 60°C max.
7.	Substrate temperature	• Option to heat the substrate. Please specify temperate range options.
8.	Power level	• Typical RF Power range 100W - 600W, with automatic power matching unit and with an option to bias the substrate (typical range of 100W - 600W). • ICP source suitable for uniform processing on up to 150 mm wafers. ICP maximum power of 3000 W, 13.56 MHz or 2MHz RF generator with automatic matching • There must be automatic matching mode. The matching should work in automatic matching mode with preset capacitor positions.
9.	Chuck configuration	• Electrostatic or mechanical chuck with the provision to handle 6-inch wafers. • Give options for the use of 4-inch wafer as well. • Options to be given for chuck with the pro and cons of using the same. • Max substrate size: up to 10 mm thick.
10.	End point detection	• Give all the options available, itemize cost.
11.	Process gases lines required	• As per process requirement for SiN and SiO2 etch.
12.	Gas Manifold	Gas manifold should have 8 lines. • MFCs need to be installed only for the lines and gases specified. All the lines should have swagelok VCR fittings or equivalent fittings and welding if any should be orbital welding. The lines should be SS316L electro-polished suitable for corrosive and noncorrosive gases used for the specific process. MFCs should be MKS make.

		• Lines should be fitted with one electro-pneumatic isolation valve and in-line filter
		• Gas box for up to at least 12 MFC controlled gas lines, fitted with
		  o 6 non-hazardous lines and viton sealed MFC
		  o 2 hazardous lines and Metal sealed MFC and bypass
		  o Lines should be fitted with one electro-pneumatic isolation valve and in-line filter.

13.	Leak Integrity	The system should have easily accessible ports for He leak testing and should be qualified by demonstration of He leak rates less than $4x10^{-9}$ sccs of He when pumped down to 10^{-3} Torr or lower pressures.
14.	Process software	• Front panel displaying equipment and process status along with appropriate software to be supplied. • The software must allow varying levels of instrument access. A simplified basic access for a user to a full access to an engineer. • Interlock that can interface with the online reservation system, so that the tools can only be used by authorized users. • Complete logs of all the process and system parameters to be available and stored for future trouble shooting. • Graphical representation of tool and process parameters • Provision to alert the user in case of emergencies and an option to integrate the alarm system to NNFC building monitoring software. • Software needs to be supported for the lifetime of the tool. • The software should perform automatic leak check and automatic MFC check. • It should have a Plasma hold function between process steps to maintain power-on • The system should not have a limit to the number of recipes it can store. • System tolerances should be editable by advanced user through the GUI. • It must be possible to mount the gas pod and PC separately.
15.	Gas abetment system	• Specify the scrubbing system needed for treating exhaust gases from etching III-V semiconductors. • Specify the exhaust system needed to do an open chamber clean after etching materials with toxic etch products. • Include gas abatement system. if required, as an option.
16.	Safety	• Mention any special safety requirement of the tool. • The tool must come with a complement of interlocks to prevent common user errors. • Sensors should be provided to detect ppb levels of gas leaks and utility failures including scrubber failure. • Any malfunction should have an audible alarm system. • Flashing lights during emergencies should also be an option.

		• The system should be left in a safe state, under vacuum, in case of failure.
17.	Qualification and Acceptance	• 100 nm SiN etch landing on AlGaN or GaN with electron-beam resist and photoresist. The process should yield features with aspect ratio 1:2.5 with <5% Critical Dimension (CD) uniformity. Expected minimum linewidth is 250 nm. • 100 nm SiN etch landing on metal for large pads: 3x50 um to 1 mm x 250 um. • Details of the stage wise certification protocols to be pursued for tool acceptance should be included in the technical bid. The PO will include a mutually agreed upon set of tool qualification criteria. Please list a set of acceptance tests for on-site (vendor) inspection and after installation at IISc.

	Common Terms and Conditions: A separate table to be included for each of the items below in the technical bid.
18.	**SEMI Standards:** The technical bid should include details of the SEMI standards the tool confirms to.
19.	**Clean Room Compatibility:** The system should be compatible with better than class 1000 cleanroom environment.
20.	**Shipping:** On all systems the cost of shipping up to IISc should be included. IISc will help with customs clearance at Bangalore Airport. Please include your payment option. IISc would prefer to retain at least 20% of payment till instruments have been commissioned and successfully demonstrated.
21.	**Tool Training:** The bid should include as an option the cost of training personnel on site before shipment and post installation at IISc.
22.	**Tool footprint and utilities**: A floor plan should be part of the technical bid. A list of utility requirements should be part of the technical bid. The system should be compatible with 240±10V, 50 Hz single phase or 415±20V, 50 Hz 3 phase supplies. The **MINIMUM** set of utility requirements needed are provided in Table 1. If there are additional utility requirements please include them in the technical bid. **Please list connector types for all utilities.**
23.	**Cost of Ownership and supply of spares:** The quote should include a listing of spares that need to be replaced periodically to ensure that the system is in operation in a stable fashion – the stability parameters being defined by the vendor and agreed to by the client – the cost of such items, the ability to guarantee their availability at this cost for a period of 5 years from the time of procurement. The aim of this exercise is to compare cost of ownerships between reactors.
24.	**Maintenance**: The cost of an annual maintenance contract and cost of emergency technical support that may involve an engineer being on site should be quoted for in the commercial bid and addressed in the technical bid. The availability of trained engineers in India for servicing the system will be preferred and should be described in the technical bid.
25.	**Maintenance:** On all systems a set of basic tools required -non-standard screw or spanner head that is required for routine tool maintenance should be mentioned- for performing routine maintenance should be included.
26.	**Maintenance:** System operation, process and troubleshooting manuals and detailed drawings

	are a must. Their inclusion must be indicated in the technical bid.
27.	**Online support:** System should have the capability for online diagnostics from a remote location in case of tool problems.
28.	**Post sales service and Indian Presence:** Bidders should provide details of after sales service and support available in India. If not India, the nearest geographical location should be specified. Please provide details of the number of trained personnel in India who can service the machine, the number of tools sold in India and the corresponding number in the southern region or in Bangalore.
29.	**Shipping:** On all systems the cost of shipping up to IISc should be included. IISc will help with customs clearance at Bangalore Airport.
30.	**Payment Terms and Conditions:** On all systems the payment terms should be specified in the technical and commercial proposal and is subject to negotiation. Please include your payment option. IISc would prefer to retain at least 20% of payment till instruments have been commissioned and successfully demonstrated.
31.	**References:** Bidders should provide details of other locations in India with similar tool installations.
32.	**References:** Bidders should provide details of at least 3 other locations globally where similar tool installations have been deployed for device fabrication in a clean room preferably for production purposes.
33.	**Company financials:** Bidder shall have to submit audited accounts of financial year 2017-18, 2018-19 and 2019-20. Audited statement must be signed and stamped by qualified chartered accounted. Income Tax return for assessment year – 2017-18, 2018-19 and 2019-20.
34.	The following documentation should be provided. ISO9001 quality certification. CE marking confirmation. Must confirm to SEMI standards to be specified in the technical quoted.
35.	**III-V nitride processing:** Please include information on whether the tool and its fixturing has been used for deposition of the said metals on GaN on Si wafers of 6” diameter for power applications.

Details to be provided in addition to other utility requirements the tool may require. If not applicable mark as NA: Not applicable.

				Electric		**Chilled Water**		**Gases**																**Exhaust**	**Thermic load**
Tool Foot Print, (LXBXH)			Area	Power consumption average	Peak power	Cooling capacity	Cooling Water Process	UHP Nitrogen	UHP Hydrogen	Dopant Silane	Pure Silane	Ammonia	Chlorine	He	Oxygen	Regular Nitrogen	CF4	CHF3	SF6	NO2	BCl3	Argon	Forming Gas		Thermic load to clean room
L (mm)	B (mm)	H (mm)	Sq.	kW	kVA	kW	l/h	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	m^3/h	kW