



### Request for Quote and Specifications of low temperature annealing tool for deposition on up to 8” substrates

- The GEECI (Gallium Nitride Ecosystem Enabling Centre and Incubator) at SID-Indian Institute of Science is seeking bids from qualified industries for rapid a low temperature anneal tool as per the specifications below.
- 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 30<sup>th</sup> day or next weekday in case the 30<sup>th</sup> 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](mailto:sraghavan@iisc.ac.in)
- Post such submission all vendors should send an email to [sraghavan@iisc.ac.in](mailto: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 items below, **technical and non-technical**, 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.

<b>Technical Details for Compliance Table: Please add columns detailing compliance, deviations if any and highlight advantages over customers.</b>	
1.	<b>Configuration: LTA (low temperature anneal furnace)</b> capable of handling 4" and 6" wafers. Specify if whether the same tool can also go up to 8". If not include a separate quote for a tool that can go up to 8".
2.	<b>Process Requirement:</b> Annealing of 4 to 6" GaN on Si and SiC substrates in the temperature range of but not limited to 350 to 650°C for up to 2 hours in various controlled environments ranging from vacuum to oxidizing to reducing atmospheres. Specify the range of operation of your tool in which PID control (or PID + other control) meeting a certain specification (Point #) is possible.
3.	<b>Temperature uniformity:</b> +/- 1°C across a 6 inch substrate in the operational temperature and specifically in the 350 to 650°C range. Any deviation from this spec should be highlighted in the technical bid. Details of mode of temperature measurement (pyrometer or thermocouple) and its use in the control should be included in the technical bid.
4.	<b>Heating and cooling rates and its control:</b> Fastest ramp rate and cool down rates should be included in the bid. Deviation from setpoint in percentage during ramp up and ramp down should be specified and should not exceed 1°C at any point in time. Deviations from this spec should be mentioned.
5.	<b>Heating mechanism:</b> Details of the heating mechanism and lifetime of the heating elements should be included. The cost of replacing the heating element should be included in the commercial bid.
6.	<b>Temperature stabilization time and overshoot:</b> The technical bid should clearly state the maximum ramp rate at which a certain degree of temperature uniformity, in ±°C, can be achieved across the wafer during the ramp. Overshoot of actual temperature from plateau set point and time taken to stabilize to the setpoint when heated at this rate should be specified in the control area. Difference between edge temperature and centre temperature at time 0 seconds on set point reaching 800°C, difference during steady state and time required to reach this steady state from time 0 seconds needs to be specified.  <b>For example:</b> Maximum heating rate of 20°C/sec <u>at which</u> during ramp temperature non-uniformity will not exceed ±5°C across a 6" wafer, overshoot from 800°C set point at control area is less than 10°C at time 0 seconds and time taken to reach set point is 10 seconds. At steady state the maximum temperature difference between edge and center is 5°C. Time taken to reach steady state is 20 seconds.
7.	<b>Pumping:</b> Dry roughing and backing pump to get down to 10 <sup>-6</sup> Torr in less than 5 minutes. Turbo should be quoted as an option.
8.	<b>Pressure control:</b> The pressure range in the chamber over which control of pressure withing +/- 1 Torr can be demonstrated should be specified in the technical quote.
9.	<b>Environment:</b> System should allow annealing in inert (Ar, N <sub>2</sub> ), reducing (H <sub>2</sub> or H <sub>2</sub> + N <sub>2</sub> ) and oxidizing (O <sub>2</sub> ) environment and suitable mixtures. Safety features need to be built in into the software to ensure prevention of accidental entry of oxidizing and reducing atmospheres. Gases flows to be controlled independently through individual dedicated MFCs interface with the control software.
10.	In case the tool vendor needs to incorporate special safety features to handle pure hydrogen, it can be quoted as an option or as a separate tool.
11.	<b>Substrates:</b> The LTA is being procured for use on up to 8 inch substrates, <b>if possible</b> , and smaller pieces in an academic setting. In particular, temperature control over 6" substrates is important. <b><u>In case the vendor has separate 6" and 8" tools they may be quoted for separately.</u></b>
12.	<b>System control:</b> All important machine parameters should be controlled through a PLC and accessible through a touch pad human machine interface (HMI) or a laptop.
13.	<b>System control:</b> A list of all safety interlocks available on the system and the cause/effect diagram that summarizes these safety features should be part of the technical bid.
14.	<b>Process recipes:</b> Process recipes for annealing of Ohmic contacts for III-V, GaN, HEMT technology if available should be mentioned.

15.	<b>Cost of ownership:</b> For a standard specified run, for instance, ramp up to 800°C in N <sub>2</sub> at 20°C/second and cool down at the same rate, the life of the various parts that need to be replaced such as the lamp bank and SiC coated graphite susceptor should be specified. The cost of such parts and guarantee of cost for a period of 5 years should be included so that the cost of ownership of the tool can be determined.
16.	<b>Shipping:</b> 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.
17.	<b>Tool Qualification and Acceptance:</b> On all systems please list a set of acceptance tests for on-site (vendor) pre-shipment inspection/qualification and after installation at IISc. The technical bid should include a tool qualification test suggested by the vendor that can be performed pre shipment and at site post installation by the customer. Customer has a device fabrication facility and can check for variation across a wafer. <u>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.</u> Please list a set of acceptance tests for on-site (vendor) inspection and after installation at IISc.
18.	<b>Tool Training:</b> The bid should include as an option the cost of training personnel on site before shipment and post installation at IISc.
19.	<b>Tool footprint and utilities:</b> 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 <b>MINIMUM</b> set of utility requirements needed are provided in Table 1. If there are additional utility requirements please include them in the technical bid. <b>Please list connector types for all utilities.</b>
20.	<b>Cost of Ownership and supply of spares:</b> 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.
21.	<b>Maintenance:</b> 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.
22.	<b>Maintenance:</b> 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.
23.	<b>Maintenance:</b> System operation, process and troubleshooting manuals and detailed drawings are a must. Their inclusion must be indicated in the technical bid.
24.	<b>Online support:</b> System should have the capability for online diagnostics from a remote location in case of tool problems.
25.	<b>Post sales service and Indian Presence:</b> 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.
26.	<b>Shipping:</b> On all systems the cost of shipping up to IISc should be included. IISc will help with customs clearance at Bangalore Airport.
27.	<b>Payment Terms and Conditions:</b> 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.
28.	<b>References:</b> Bidders should provide details of other locations in India with similar tool installations.
29.	<b>References:</b> 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.
30.	<b>Company financials:</b> 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.
31.	The following documentation should be provided. ISO9001 quality certification. CE marking confirmation.
32.	<b>III-V nitride processing:</b> 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.

				<b>Electric</b>	<b>Chilled Water</b>	<b>Gases</b>														<b>Exhaust</b>	<b>Thermic load</b>		
L (mm)	Tool Foot Print, (LXBXH)			Power consumption average	Cooling capacity	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
B (mm)			Area	Peak power	Cooling Water Process	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	slpm	m <sup>3</sup> /h	kW
H (mm)																							
Sq. Metre																							