



Request for Quote and Specifications of e-beam lithography tool

- The GEECI (Gallium Nitride Ecosystem Enabling Centre and Incubator) at SID-Indian Institute of Science is seeking bids from qualified industries for an electron beam lithography 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 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 numbered 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.

1.	Primary application	<ul style="list-style-type: none"> Align and expose of various layers on a 100 and 150 mm wafer.
2.	Electron beam systems	<ul style="list-style-type: none"> Acceleration voltage: 50 and 100 kV High brightness thermal field emission gun with a typical lifetime of about 10000 hours. Continuously variable: 100pA to 100nA. Vendor to specify current range Vs aperture table. 200 to 200000; facility to change or choose magnification through a computer must be inbuilt. Facility to vary the current and spot sizes continuously is required; automatic closed-loop correction mechanism and calibration using the software must be provided. To achieve appropriate spot sizes, provision for selection to be provided. Less than $\pm 0.5\%$ per hour (open loop). The system should have a provision for automatic probe current drift compensation for the entire probe current range. Worst case open-loop beam position drift to be less than 50nm per hour. The system should have a provision for automatic positional beam drift compensation for the entire probe current range. Less than $\pm 1\%$ over 1000μ field for the entire probe current range. Details of active or passive EMI/magnetic field cancellation options available should be included in the quote.
3.	Spot size	<ul style="list-style-type: none"> At 100 KV, 8 nm or better. Variable up to 100 nm also at 100 KV Provide details of Spot size Vs writing resolution.
4.	Spot table	<ul style="list-style-type: none"> Ability to create and recall/use repeatable spot tables.
5.	Linewidth	<ul style="list-style-type: none"> A minimum resist line width of 20 nm or better at 100 KV
6.	Substrate stage	<ul style="list-style-type: none"> Exposure area 150 X 150 mm. 200 mm X 200 mm as an option. Air-cooled stepper motor preferable. LASER interferometer based positional control with 0.6 nm or better resolution. Vertical stage range of 5 mm or more. Provide details of how wafer bow is handled as part of e-beam focusing
7.	Photoresist	<ul style="list-style-type: none"> Vendor to recommend suitable photoresist for best pattern fidelity, uniformity, and yield.
8.	Particle per wafer front side	<ul style="list-style-type: none"> Vendor to specify.
9.	Particle per wafer backside	<ul style="list-style-type: none"> Vendor to specify.
10.	Pattern generator	<ul style="list-style-type: none"> Vector Scan using a spot beam with Gaussian distribution.

	and lens system	<p>Provide other writing modes [Raster scan] if available.</p> <ul style="list-style-type: none"> • All shapes should be possible to be written, especially curves, using the basic shapes—method of formation of shapes to be mentioned by the manufacturer. • 20-bit resolution or better for beam position. Specify higher resolution, if possible. • 13 bit or better for writing shapes. Specify higher resolution, if possible. • Writing speed 50 MHz or better. Specify high-speed option. • 0.16 to 1 nm variable address grid size for the main deflector. • 0.08 to 0.5 nm variable address grid size for the sub-filed deflector.
11.	Overlay accuracy	<ul style="list-style-type: none"> • Field stitching accuracy ± 15 nm or better for a 100 μm field at 100 KV • Field stitching accuracy ± 25 nm or better for a 500 μm field at 100 KV or largest field available as standard. • Mention optional large fields available and their stitching accuracy. Preferably at 1000 μm. • Specify best achievable overlay with respect to filed area and acceleration voltage. • Ability to perform stich error-free writing. Specify the stitching accuracy of the system.
12.	In-field distortion	<ul style="list-style-type: none"> • Provide details of in-field distortion.
13.	Alignment	<ul style="list-style-type: none"> • Software should be able to perform global alignment of the wafer to notch or flat. • Software should automatically correct errors in position, rotation, and run-out errors. • The software should facilitate mix-and-match alignment operation with features realized with optical lithography.
14.	Dosage setting	<ul style="list-style-type: none"> • No. of stepping frequencies should be 2^{14} or more.
15.	Field size	<ul style="list-style-type: none"> • Specify maximum selectable field size and steps. • Specify all available field size also provide options for large field sizes.
16.	Substrate and holder requirement	<ul style="list-style-type: none"> • Wafer substrate 4-inch and 6-inch compatible. • System should be able to handle small cut pieces of few cm^2. • Substrate type: Silicon, Sapphire, Silicon Carbide, GaN. • Mask plate substrate size 4-inch and 5-inch. • Mask plate substrate size 6-inch and 7-inch as an option. • Wafer substrate thickness 300-800 micrometre. • Mask plate substrate thickness 0.06-0.25 inches. • The substrate holder should be non-magnetic. • Add appropriate substrate holder for charging substrates. • All the holders must be spring-loaded reference holders. • The holder must have a docking arrangement with the X-Y stage table.

		<ul style="list-style-type: none"> • Vendor to provide details of substrate holding mechanism.
17.	Wafer substrate loading	<ul style="list-style-type: none"> • Ability to process multiple small samples on a single holder. • Ability to take number wafers from a full-wafer cassette. • Load lock option for automatic substrate pickup holder into the process chamber.
18.	Substrate pre-alignment	<ul style="list-style-type: none"> • System should allow pre-alignment of the substrate with translational (X and Y) and rotational control. • Include an option for a stand-alone pre-alignment microscope for the alignment of wafers externally on the wafer holder.
19.	Substrate grounding	<ul style="list-style-type: none"> • Arrangement for grounding of wafers/ masks/ substrates must be provided on all holders.
20.	Current measurement	<ul style="list-style-type: none"> • All the sample holders should have Faraday Cup with an integrated auto range pico-ammeter having an accuracy of better than 0.5%.
21.	Calibration	<ul style="list-style-type: none"> • Calibrations and dynamic online corrections for deflection, focus, astigmatism and height variations. • Optional Back scatter detector to be provided. • Measurement and calibration of beam current, beam position, focus, field size and height must be provided. • The system should have the facility for global, local and chip-level alignment by registration of defined markers. • Silicon- (or suitable) substrate with suitable metal markers for beam formation, deflection, focus and astigmatism calibration and drift compensation. • Software (stand-alone or integrated) for alignments (global, local and chip alignment) distortion corrections for drift, position, rotation, off-axis focus, stigmatism, etc. must be provided. • Secondary electron detector should have automatic contrast/brightness with manual override. At the lowest working current, it should give a legible signal and support all the calibration routines. (inline or ET) • Marker detection speed shall be <1 sec/marker for beam currents of 1nA to 100nA, <1.8sec for 100pA to 1nA.
22.	Footprint, weight, and heat load	<ul style="list-style-type: none"> • The system should be compatible with a better than class 100 cleanroom environment. Please specify the total footprint in cm x cm and weight, including the heat load on the cleanroom. • Specify any special environment requirement.
23.	Pattern preparation and Process software	<ul style="list-style-type: none"> • Front panel displaying equipment and process status along with appropriate software to be supplied. • The software must allow varying levels of instrument access. Simplified basic access for a user to full access to an engineer. • Software should allow remote logging for system control. • Software should be able to prepare a pattern for desired design. • Software should be able to perform proximity correction.

		<ul style="list-style-type: none"> • 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 troubleshooting. • Graphical representation of tool and process parameters. • Software needs to be supported for the lifetime of the tool. • Software should be running on OEM supported Windows or Linux operating system.
24.	Safety	<ul style="list-style-type: none"> • Mention any special safety requirement of the tool. • The tool must come with a complement of interlocks to prevent common user errors. • Any malfunction should have an audible alarm system. • Flashing lights during emergencies should also be an option.
	Common Terms and Conditions: A separate table to be included for each of the items below in the technical bid.	
25.	SEMI Standards: The technical bid should include details of the SEMI standards the tool confirms to.	
26.	Clean Room Compatibility: The system should be compatible with better than class 1000 cleanroom environment.	
27.	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.	
28.	Tool Qualification and Acceptance: <ul style="list-style-type: none"> • The systems should be commissioned and isolated lines and line/space patterning in electron-beam resist with 100 nm critical dimension should be demonstrated post installation at IISc. Vendor is welcome to specify tool location parameters to meet these requirements. • The isolated lines and line/space structures should be 4 mm long without stitching error. • Acceptance test should include SEM and other suitable characterization methods for process qualification. • Recipes to be provided for all requested process with starting points and trend information. • <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. Please list a set of acceptance tests for on-site (vendor) pre-purchase inspection and after installation at IISc.</u> 	
29.	Tool Training: The bid should include as an option the cost of training personnel at vendor's site before shipment and on site at IISc post installation.	
30.	8. Tool footprint and utilities: A floor plan and 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.
31.	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.
32.	Maintenance: The cost of an annual maintenance contract and cost of emergency technical support that may involve an engineer being on site within a stipulate period of time (e.g. 48 hours) 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.
33.	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.
34.	Maintenance: System operation, process and troubleshooting manuals and detailed drawings are a must. Their inclusion must be indicated in the technical bid.
35.	Online support: System should have the capability for online diagnostics from a remote location in case of tool problems.
36.	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.
37.	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.
38.	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.
39.	References: Bidders should provide details of other locations in India with similar tool installations.
40.	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. Contact details should be provided along with the bids.
41.	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.
42.	The following documentation should be provided. ISO9001 quality certification. CE marking confirmation.

60	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.

