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Jan 27th, 2020

To Whom It May Concern
Limited Tender for a DRIE System

This is an RFQ (Request for Quote) for procurement of a DRIE system as part of a limited tender for Centre for Nano Science and Engineering (CeNSE) at IISc, Bangalore.

CeNSE is a multidisciplinary research department at IISc that houses a 14,000 sq. ft. cleanroom and characterization facility used by 50 faculty members from various disciplines at IISc. CeNSE also runs a program called Indian Nanoelectronics Users Program (INUP) which has allowed 4200 participants from more than 700 universities and institutes all over India to use the facilities at CeNSE. Consequently, any tool in CeNSE receives significant exposure to the scientific community at IISc and beyond. The vendors are requested to factor in the value of this exposure into their quotes. Details of existing facilities and INUP program can be gleaned from:
http://www.cense.iisc.ac.in/
http://nnfc.cense.iisc.ac.in/
http://www.mncf.cense.iisc.ac.in/
https://www.inup.cense.iisc.ac.in/

Also, CeNSE hosts equipment on behalf of vendors, as a national standard or 'model' system. If the vendor is interested, CeNSE can consider working out a similar arrangement for the DRIE system.

Procedure
1. Vendors will be required to submit a technical proposal and a commercial proposal in **two separate sealed envelopes**. Only vendors who meet the technical requirement will be considered for commercial negotiation.
2. **The updated deadline for submission of proposals is the 31st of Jan 2020, 5:30 pm Indian Standard Time. No further extension will be given on the deadline.** Proposals should arrive at the Main office, GF-15, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India, by the above deadline.
3. The decision of the purchase committee will be final.
4. The technical proposal should contain a compliance table with 5 columns. The first column must list the technical requirements, in the order that they are given in the technical configuration below. The second column should describe your compliance in a "Yes" or "No" response. If "No" the third column should provide the extent of the deviation (please provide quantitative responses). The fourth column should state the reasons for the deviation if any. The fourth column can be used to compare your tool with that of your competitors or provide details as requested in the technical requirements table below.
5. 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.

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6. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors

7. If multiple systems can fulfil the requirements, vendors can submit multiple bids.

8. In the commercial bid, please provide an itemized cost of the system and *required* accessories, such as software, power supply, etc.

9. 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.

10. The quotes should be CIF Bangalore, India. So please include the cost of shipping.

11. Please indicate the warranty provided with the tool. Warrant of 3 years of more is preferred.

12. Provide itemized cost for *required* spares for 2 years of operation. For the sake of this calculation, the vendor may assume active tool usage of 20 hours/ week. This number will be used to estimate the life cycle cost of the tool.

13. Clarify if periodic (preventive) maintenance be done by a trained on-site engineer or requires a specialist from the OEM.

14. If maintenance requires OEM, as an additional option, provide the cost of an annual maintenance contract (AMC) for 3 years, post-warranty. The AMC must cover 1 scheduled and 1 emergency visit per year. It must also indicate who will service the AMC, an Indian agent or the OEM. The AMC cost must also include an itemized list of spares that are essential for the scheduled visits.

15. The RFQ must include references of 3 previous installations, preferable in India. Please provide the names and contact addresses of the referees, so that the committee can contact them independently.

16. Interested OEMs should contact Dr. Savitha (savithap@iisc.ac.in) for demo samples.

17. We reserve the right to deny the demo sample based on the legitimacy and vendor experience in DRIE system.

18. Technical bid will not be accepted without the demo sample result.

19. Any questions can be directed to Dr. Savitha P, GF-20, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India. (savithap@iisc.ac.in)

Technical Requirements

1.	Primary application	• Anisotropic Deep Reactive ion etching of Si and Si in Silicon-on-Insulator • Shallow etches of Silicon (<5um depth) • Must conform to some SEMI standard for ICP equipment manufacturing, e.g. SEMI SEMI E6-0914,SEMI E15-0698E2 , SEMI S21-1106E , SEMI S19-0311 (Reapproved 0816), etc.
2.	Secondary application	• Isotropic etch of Si
3.	Process capability	• Through Silicon etch using BOSCH process with the minimum (CD)critical dimension(10um & above) for substrate thickness of 500um and above • Silicon etch >25um deep, with CD <=1um on SOI, with less or no trenching

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		and notching(footing)
		• High etch rate(>30um/min) and low etch rate(<5um/min) recipes
		• Anisotropic etch profile i.e vertical sidewalls of 90˚ with +/- 1 ˚ variation
		• Etch uniformity <5% with design(etch) density of 30% to 60% for same CDs and <10% for varied dimensions
		• CD variation of <5% after etching across 4inch wafer
		• Etch aspect ratio 1:50 or better for trenches from nm to micron ranges
		• Soft landing on thin membranes of material like SiO2(Thermal, PECVD, LPCVD etc.,) of thickness <500 nm(minimum 100nm) , of square or circular dimension of <1mm (minimum 50um)
		• High etch selectivity of >800 with SiO2 mask and >200 with AZ4562 resist
		• Smooth sidewall scallop/roughness <50nm for low etch rate and <300nm for high etch rates
		• No grass formation/micro masking on the bottom surface of the etch
		• Plasma dicing for die separation and etch for substrate planarization
		• Metal etch mask without effecting the sanity of the tool and standard processes(optional)
		• 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	• Provide standard high and low etch rate recipes at the time of installation • Provision to create, edit and save a minimum of 100 recipes
5.	Substrate details	• Processing of up to 4 inch Silicon wafers, Glass(optional) • Suitable substrate adapters to process 6-inch wafers should be available as an option • Thickness: 300um to 1000um
6.	Etch Mask	• SiO2(Thermal, PECVD) • Photoresist (AZ4562 or equivalent) • Metals (Optional) • Please specify other possible materials and etch selectivity
7.	Tool requirements	• Load lock chamber: software controlled load and unload options • Wider matching network • The roughing vacuum pump for the main chamber and load lock chamber should be dry pumps (preferably Edwards) with appropriate pumping capacity. Turbomolecular pump with the appropriate capacity for ensuring the required process vacuum. • Helium substrate cooling

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8.	Substrate temperature	• -30 to 60°C. If this is an additional requirement, itemize cost
9.	Power level	• Platen RF Power of up to 600W(HF 13.56MHz and 300kHz> LF <400kHz) with automatic power matching unit • ICP power of up to 6 KW(13.56MHz)
10	Chuck configuration	• Electrostatic chuck to handle up to 4-inch wafers give details on handling small Si samples of ~1cmx1cm • Also give as option provision to process 6 inch wafer • Options to be given for mechanical chuck, with the pro and cons of using the same.
11	End point detection	• Give all the options available, itemize the cost.
12	Process gases lines required	**1.O2** **2.N2** **3.SF6** **4. C4F8** **5. He** **6. Empty line** **7. Empty line** **8. Empty line**
13	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 and welding if any should be orbital welding. The lines should be SS316L electro-polished suitable for corrosive and non corrosive gases used for the specific process. MFCs should be MKS make.
14	Footprint& weight	• The system should compatible with better than class 1000 cleanroom environment. Please specify the total foot print in cm x cm, and weight.
15	Process software	• A 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 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 troubleshooting • 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

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16	Periodic Maintenance	• The system should require minimal maintenance. • Mention the recommended preventive maintenance schedule for the system. Any accessories needed for periodic preventive maintenance for 3 years e.g. O-rings, should be mentioned in separately the itemized quote. • Can the preventive maintenance be done by a trained on-site engineer or requires a specialist from the OEM? If the latter, please provide the cost of a 3 year AMC with required kit/consumables. • The system should be supported by a trained local representative and should have a 48hour window of response
17	Installation and Training	• Installation and training at the customer site, by the experts from principals, should be part of the package. • During the installation, all the specifications of the processes should be verified for acceptance by the customer. • If periodic maintenance can be done by the on-site engineer, please include the cost of training the engineer.
18	Power& utilities	• The instrument should work with Indian standards • Mention the power requirement. • Mention any utility requirement (water, air, exhaust, etc.)
19	Gas abetment system	• Specify if any the scrubbing system is needed for treating exhaust gases from etching, provide the same as an option
20	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
21	Recommendation	• The system must submit references from at least 3 previous installations • The names and contact addresses of the referees must be submitted with the proposal, so the purchase committee can contact them independently.
22	Pre-purchase testing	• To ensure the equipment conforms for specifications, the committee requires the vendor to perform some standard tests. The validity of the tender will hinge on the successful and accurate measurement of these test samples. • The vendor must conclude the testing and submit the data within 1 week

(Row above table 16): • Latest Software need and to be supported for the lifetime of the tool

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		of receipt of samples.
23	Acceptance tests	• Si etch of CD <2um and depth of 25um on SOI • Through Silicon via etching of Si, CD 10um , depth 500um • Demonstrate working of all the accessories including endpoint detector •
24	Technical Bid acceptance	• In addition to response to item 1-23, vendors should provide cross-section SEM of Silicon and Silicon-on-Insulator etch demo. • One Si and One SOI sample will be given with etch mask (please contact savithap@iisc.ac.in for samples). • Cross-section results both in soft copy and hard copy should be attached with the bid. • Etch samples should be returned to CeNSE without any further processing • CeNSE shall do a verification cross-section to confirm the results. • The technical bid will not be accepted without the demo sample result. • Etch results should comply with the requirement listed in item-3

Thanking you,

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