Tender Notification for the procurement of Si, SiGe and Ge Epitaxial CVD Systems

To Whom It May Concern

This is an RFP (Request for Proposal) document for procurement of an epitaxial CVD system along with attachments as part of a tender for the Centre for Nano Science and Engineering (CeNSE) at IISc, Bangalore. The CVD reactor will be primarily used to deposit thick layers of for Si, SiGe and Ge for MEMS and electronics devices.

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 scientific community at IISc and beyond. The vendors are requested to factor in the utility of this exposure in the quotes.

Procedure:

1. Vendors are 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 the commercial negotiation.
2. The decision of purchase committee will be final.
3. 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.
4. 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.
5. The **deadline for submission of proposals is the 23rd of April 2019, 5:30 pm Indian Standard Time**. Proposals should arrive at the office of Dr. Saurabh Chandorkar, FF-08, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India, by the above deadline.
6. The **quotes should be CIF Bangalore, India.** Please include cost of shipping.
7. The technical requirements are listed for Si, SiGe, Ge epitaxy.
8. Please provide itemized quotes for the tool and any extra options/attachments/packages. Vendors are encouraged to quote for as many options as their tool portfolio permits.

9. Please indicate the warranty provided with the tool. Longer (3 year) warranty periods are preferable.
10. As an option, please provide cost of annual maintenance contract (AMC) for 3 years after warranty, The AMC must cover 2 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.
11. Please provide an itemized cost for spares expected over 2 years of use. These shall be used to estimate life-cycle cost of the tool.
12. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.
13. Any questions or clarifications can be directed to: Dr. Saurabh Chandorkar
FF-08, Centre for Nano Science and Engineering, Indian
Institute of Science, Bangalore 560012
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T +91 80 2293 3638

Technical Specifications

NNfC has a requirement for Si, SiGe, Ge Epitaxial CVD system. The technical specifications are listed below:

Chamber configuration

Chamber Temperature	Atleast 450-1200 C
Process Pressure	6-60 Torr
Base Pressure	50 mTorr
Deposition Rate	> 0.2 um/min film for a 5-10um epitaxial Si film deposition with high p type doping on 4'' SOI wafer
Film thickness uniformity across wafer excluding 6mm from the edge of wafer	<+/- 5% for a 5-10um epitaxial Si film deposited at rate >0.2um/min with high p type doping on a 4'' SOI wafer
Dopant uniformity measured using sheet resistance measurement across wafer excluding 6mm from the edge of wafer	<+/- 5% for a 5-10um epitaxial Si film deposited at rate >0.2um/min with high p type doping on a 4'' SOI wafer
Deposition thickness during an uninterrupted run	From 50 nm to 50 um
Number of wafers/run	1
Wafer size	System can process 4'', 3'', 2'' and smaller coupons as well
Cleanliness	Loader is cantilevered and does not touch the tube wall
Hot/Cold Walled Chamber	Cold walled strongly preferred. If vendor suggests hot walled chamber, provide justification.
Selective Deposition using HCl flow	Hardware capability should be present (see gas line specs)

General specifications:

Required Item	Further specification
Gas abetment system	Required
Gas panel	Required (including setup for liquid precursors)
Load lock	Required
Wafer Loading	Automatic preferred
Maximum time spent in transferring a wafer from loader to chamber (maximum time spent in a load lock)	<5 minutes
Weight	To be specified
Size	To be specified
EMO (soft for software reset) and a button for hard reset	Yes
Tool status lamp	Yes
Process interlocks as per recipe	Generally: >x% deviation from set point triggers interlocks (where x should be set by default to 5 and could be set by user using administrative privileges)
Process parameter log	Every parameter sampled at ~1Hz Data retained for 100 runs. Logs recorded in chunks of 10MB or less
Tool log	Software log recorded in chunks of 10MB or less
Multi-step recipe creation	**C**ontrol flow rates of all gasses, chamber pressure, temperature and other process step parameters
Computer interface showing current status of gas flows, chamber status, load lock status etc.	In addition, Tool errors should be clearly articulated with appropriate pop up messages as well as logged.
Tool interlock	Tool must accept external interlock so that it can interface with NNfC reservation system

Gas Specification

Gas		**Concentration**	**Suggested** Max **Flows** Minimum flow= 2% of Max
Purge	H_2 *	100% (5N5)	>70 SLM
Purge	N_2*	100% (4N8)	>50 SLM
Deposition	SiH_4*	100% (6N)	100 SCCM
Deposition	GeH_4*	100% (5N)	100 SCCM
Deposition	$SiCl_2H_2$*	100% (3N)	100 SCCM
Dopant	B_2H_6*	2% (balance 5N5 H_2) 100 PPM (balance 5N5 H_2) To be diluted using H_2 and the 2% B_2H_6	500 SCCM 500 SCCM
Dopant	PH_3*	1% (balance 5N5 H_2) 100 PPM (balance H_2) To be diluted using H_2 and the 1% PH_3	500 SCCM 500 SCCM
Dilution line	H_2	100 PPM (balance 5N5 H_2)	10 SLM
Dopant	AsH_3*	100% (5N)	500 SCCM
Etchant for selectivity	HCl**	100% (5N)	500 SCCM
1 Extra gas line	Spare**	Calibrated for hydrogen	500 SCCM
1 extra bubbler Loop	Spare**	Calibrated for hydrogen	Implied 0.2 SCCM

* Gases that are already available in NNfC. The concentration of these gasses is fixed.
**New gas lines that need to be added. The concentration/specification of these gasses can be changed.

Source Inspection

Vendors are required to send a complete hierarchical bill of materials (including mechanical, electrical, pneumatic, hydraulic parts and shipping crates) before the source inspection will be carried out. The Vendor is to notify IISc thirty (30) days in advance of factory final testing. An IISc representative may be dispatched to the Supplier for Source Inspection. The purpose of the Source Inspection is to:

- Observe testing of all ordered equipment.
- Check for equipment compliance with this specification or configuration specification.

- Check for functionality of interlocks.
- Check for manufacturing defects.

Tool aspect being tested	Test	Spec
Go over the BOM to verify presence of all components	Verify appropriate assembly of various parts in BOM	All parts should be present
Load Lock loading	25 consecutive load and unload steps in chamber	No failures
Continuous operation of tool with no failures	3 successive recipe runs with inert gasses. Inert gas recipes should mimic the recipe for 5-10um epitaxial Si film deposited at rate >0.2um/min with high p type doping on a 4'' SOI wafer	No failures

Tool acceptance tests (upon delivery)

Tool aspect being tested	Test	Spec
Wafer transfer check	10 consecutive runs of: Wafer loader-> Load lock->Process chamber->Load lock -> Wafer loader	No failures
Continuous operation of tool with no failures without tube maintenance	3 successive recipe runs for the recipe: >0.2um/min deposition of 5-10um of epitaxial Si film with high p type doping on a 4'' SOI wafer	No failures
Deposition uniformity (within wafer and across runs)	Wafers used in above test will be checked for deposition uniformity excluding 6mm outside edge	9 point check; sigma/mu <0.05 with alpha = 0.05, beta = 0.05

Other requirements

- **Vendor MUST have at least one installation of a CVD system in India and have a local support person (must be technical support in Bangalore)**
- List of required utilities must be provided by the vendor.
- Option for NRTL certification

- Tool must adhere to safety code (SEMI S2-0200, SEMI S8-0999)
- Complete manual (hardware and software) should be provided
- Complete tool specification document including but not limited to all interlocks, complete set of circuit diagrams, top level bill of materials etc.
- Provide suitable Warranty Period (minimum of 1 year) and clear warranty terms
- Provide after warranty option for 3 year AMC + required AMC kit/spares
- 3 references, preferably Indian, from people using this system need to be furnished with the bid
- Detailed preventive maintenance requirements and procedures are to be provided
- Include installation costs and training costs. Training can be on-site or at vendor location.
- The payment terms are negotiable.
- The bid will be considered valid for 90 days after the last date of bid acceptance (i.e. 23rd April 2019).
- Shipping: Bangalore CIF