National Centre for Nanoscience & Nanotechnology
University of Mumbai
(NCNNUM)

National Center for Nanoscience and Nanotechnology
University of Mumbai, Vidyanagari, Santacruz (E), Mumbai 400 098, India.
Tel: (022) 2654 3495, Fax (022) 26530299 Email: director@nano.mu.ac.in

Tender Document for

PLASMA ENHANCED CHEMICAL VAPOUR DEPOSITION (PECVD) CUM PLASMA POLYMERIZATION

No: NCNNUM/Tender/578/2013

Date: 22 April 2013

Part A - Terms and Conditions

Part B – Specifications

Price: Rs. 500/- (non refundable)

Important Dates:

Last date of Sale of Tender Document	06th May 2013, 1.00 pm
Last Date of Receiving sealed Bids/Tenders:	06th May 2013, 5.00 pm
Tender opening	09th May 2013, 3.00 pm

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Tender Document for

PLASMA ENHANCED CHEMICAL VAPOUR DEPOSITION (PECVD) CUM PLASMA POLYMERIZATION

No: NCNNUM/Tender/578/2013

Date: 22nd April 2013

Part A - Terms and Conditions

Tender Notice

National Center for Nanoscience and Nanotechnology
University of Mumbai, Vidyanagari, Santacruz (E),
Mumbai 400 098, India
Tel: (022) 2654 3495, Fax (022) 26530299
NCNNUM/578/ of 2013
Date: 22nd April 2013

Sealed Tender bids for the purchase of **Plasma Enhanced Chemical Vapour Deposition (PECVD) Cum Plasma Polymerization Unit,** for National Center for Nanoscience and Nanotechnology, University of Mumbai are invited for and on behalf of University of Mumbai by the Director, NCNNUM. Following schedule shall be maintained for various processes,

Last date of Sale of Tender Document	06th May 2013, 1.00 pm
Last Date of Receiving sealed Bids:	06th May 2013, 5.00 pm
Technical Bid opening	09th May 2013, 3.00 pm

Tender Document containing terms and conditions and technical specifications are available in the Office of the National Center for Nanoscience and Nanotechnology, University of Mumbai, Vidyanagari, Santacruz (E), Mumbai 400 098, on all working days between 11.00 a.m. & 4.00 p.m. from 22nd April 2013 to till 5 pm of 06th May 2013. Terms & conditions and technical specifications can also be downloaded. **For downloading, click here.** In case, the tender document is downloaded from the website, the Tender Document fee of Rs. 500/- should be enclosed in the Technical Bid Envelop, in the form of a Demand Draft drawn in favour of **"Finance and Accounts officer, University of Mumbai".** The tender bids duly complete in all respects, along with the necessary documents should be submitted to The Director, National Center for Nanoscience and Nanotechnology, University of Mumbai.

The technical bids so received, shall be opened on 09th May 2013, at 3 pm in the office of The Director, National Center for Nanoscience and Nanotechnology, University of Mumbai in the presence of the representatives of the suppliers. The Financial bids of the tenderers shall be opened on the same day or on the following day. The names of shortlisted tenderers shall be announced on the website after scrutinizing the Technical bids and evaluating their suitability to meet the University requirements. Right to reject any or all tenders, without assigning any reason thereof is reserved by the University of Mumbai.

Sd/-
Director,
NCNNUM,
University of Mumbai

Terms and Conditions of Supply

1. The last date and time for the acceptance of the bids is **06th May 2013, 5.00 pm**
2. Suppliers shall submit the following documents along with their quotations **(which should be placed in the Technical Bid Envelope, i.e Envelope No. 1**).
   (a) Income-Tax clearance certificate from the Income-Tax Officer concerned, certifying that the tenderer has cleared all the Income-Tax dues. Copies of Income Tax returns shall be applicable.
   (b) Suppliers should be either manufacturer or authorized dealer of the said equipment and should submit the proof for the same. Also, the suppliers should state whether they are a Proprietary Firm, Partnership Firm or a Private/Public Limited Company and furnish the proof of the same.
   (c) The names of the organizations and laboratories for which similar work carried out.
   (d) Earnest Money Deposit in the form of a Demand Draft drawn in favour of **"Finance and Accounts officer, University of Mumbai"** on any Nationalized Bank, payable at Mumbai. Alternately, BG from a Nationalised Bank only may be acceptable. The amount of Earnest Money Deposit shall be Rs. 2,00,000/- (Rs Two Lacs only).
   (e) In case, the tender document is downloaded from the website, the Tender Document fee of Rs. 500/- should be enclosed in the form of a Demand Draft drawn in favour of **"Finance and Accounts officer, University of Mumbai"**
   (f) VAT Registration No.
   (g) Technical specifications offered by the Supplier.
   (h) Technical compliance table
   (i) Proprietary certificate, if any, should be included in the Technical bid

3. The rates should be mentioned in the **Schedule** attached with the Tender Document. Each page of the tender shall be signed in full and stamped with the seal by the supplier. The supplier must clearly state in what capacity he or she is signing the tender. **(which should be placed in the Financial Bid Envelope, i.e Envelope No. 2)**

4. The supplier shall submit the tender in two envelopes. The first envelope (Technical Bid) shall contain all the documents referred to in **para two above** and sealed. The second envelope (Commercial Bid) shall contain the **Schedule,** in which the supplier shall register the rates of supply. The second envelope shall also, likewise, be sealed. Both the envelope then should be put together, and shall be sealed in an envelope, and shall prescribe time and date. The Technical Bid shall be opened first to ensure that supplier have submitted all the requisite documents. If the Technical Bids are not in order or are deficient in some respect, the commercial bids in respect of such tenders shall not be opened. The date and time of opening the Financial bids shall be announced immediately after opening all the Technical bids.

5. Tender bids not accompanied by the requisite amount of Earnest Money Deposit are liable to be rejected

6. The Earnest Money Deposit paid by the supplier shall be forfeited, if the supplier fails to pay the necessary security deposit in the event of his tender being accepted.

7. The amount of Security Deposit/Performance Guarantee shall be 5 % of the cost. In case of successful tenderer the amount of Earnest Money Deposit shall be converted in Security Deposit / Performance Guarantee. Security Deposit / Performance Guarantee shall be refunded after the warranty period is over. The Security Deposit / Performance Guarantee can be paid in the form of a Bank Guarantee from a scheduled bank will be deducted from the payments being made to the supplier against every bill.

8. Supplier should read carefully all the instructions and terms and conditions, etc before registering rates in prescribed schedule of the tender. Taxes and duties etc, should be shown separately.

9. The offers made by the suppliers shall be open for acceptance within 120 days after the last date of submission of tender.

10. The Technical Documents shall be opened by The Director, National Center for Nanoscience and Nanotechnology, at 3.00 p.m. on 09th May 2013, for those bids for which minimum three Vendors have participated. The tenderers or their authorized representatives shall be allowed to be present at the time of opening of the tenders. Financial bids of only qualified tenderers shall be opened. The date and time of opening the financial bids shall be announced immediately after opening all the Technical bids.

11. In case of imported items/equipments, the rates should be quoted in the light of exemptions enjoyed by educational institutions. University is exempted from the payment of Octroi and the necessary certificate/form can be issued by the University. The customs duty applicable to the University of Mumbai is maximum 5% of the invoice.

12. Technical specifications of the instruments/equipments/articles are given in Annexure to these papers (Part B).

13. The delivery, installation of the works should be completed within 4 months from date of design review and acceptance placing of the order. No extension shall be granted to the contractors/suppliers for the period of delivery, under any circumstances. All drawings to be approved by NCNNUM. No change is allowed without written permission.

14. In case of delayed supplies / installation of the equipments at NCNNUM, liquidated damages at the rate of 1 percent per week of delay with a maximum of 5 percent will be levied.

15. If the supplier fails to deliver the article as per the delivery schedule, the University of Mumbai shall be free to procure the balance/undelivered supply, at the risk and cost of the supplier, from other such suppliers

16. The goods, articles, materials supplied by the supplier shall be accepted after inspection by an officer authorized by the competent authority. No articles/materials which

do not conform to the specifications laid down in the terms and conditions or damaged in transit accepted

17. Before tendering, the tenderer shall inspect the site to fully acquaint himself with the condition in regard to accessibility of site, working condition of site and locality including unloading of materials, installation of tools and plants, etc., required for the satisfactory execution of the work contract. No separate claim whatsoever on these accounts shall be entertained by the University of Mumbai. No claim for expenses incurred in the site visit will be entertained by the University of Mumbai

18. The bills of suppliers shall be paid by the University only after the complete installation of system as per the stated specification in the tender documents and certified test reports are submitted

19. Only those contractors who can execute the complete project shall submit their bids. Bids received for part work shall not be considered. Tenderers of the PECVD system should provide the entire equipments as described in part B, and will be responsible for the design, development and installation of the complete instrument.

20. The vendor must assume responsibility for any damage to equipment during the shipping process or unloading to NCNNUM

21. Vendor must submit Compliance statement in tabular form comparing each specification of the quoted item with that given in the Tender Document part B. The Vendor also must supply a soft copy of the Table only in Microsoft word format.

22. If the equipment is imported and requires PC, printer other peripherals, they can be bought from India and should be of International brand such as HP. The monitor should be LCD/TFT screen. The printer should be LaserJet printer. The processor should be Intel latest processor. The amount quoted for the items bought in India, installation; servicing etc. can be in Indian Rupees and the imported items can be quoted in foreign currency.

23. The warranty period shall be of 2 year from the date of complete and satisfactory installation of the system.

24. As the suppliers shall be responsible for the supply and installation of equipment at Mumbai, the cost towards insurance until destination in the University, shall be borne by suppliers.

25. In the event of any breach of the terms and conditions of the supply, the University of Mumbai may terminate the contract placed with the supplier and forfeit the security deposit or the supplier.

26. Right to reject any or all tenders without assigning any reason there for is reserved by the University of Mumbai

Prequalification Criteria

A. Qualification Criteria for the System Vendor.

a) The vendor must be a well established company with a long experience in the field of thin film deposition using Plasma Enhanced Chemical Vapour Deposition (PECVD) and with proven application development expertise. The vendor must have a long track record of at least 10 years in development of PECVD systems

b) In case of foreign manufacturers , the vendor must have an Indian representative who will assist in the technical aspects , procurement process and provide after-sales service

c) The vendor must have PECVD applications lab with PECVD system – lab scientists / engineers available for consultation on PECVD processes.

d) The vendor must have service centre in Mumbai for after sales service.

e) The vendor should quote for all the optional accessories mentioned in section 13

B. Qualification Criteria for the Product Brand (PECVD system)

a) The brand of PECVD system (Make) being quoted must have a record of being in use for at least 10 years in well known production or research establishments. The vendor must provide references to that effect. Documents citing technological / research breakthroughs achieved by users of the brand will be given weight during the selection process.

b) The PECVD system should be customizable, so as to be suitable for use under conditions, and as per specifications provided by the end user (NCNNUM)

c) The PECVD system should be flexible enough to work with individual components (temperature controllers, vacuum gauges, vacuum pumps, etc) provided by major providers not affiliated with the system provider.

d) The PECVD system should be robust and contain adequate mechanisms to withstand short disruptions of the facilities (power, water, liquid nitrogen, compressed air, etc) without catastrophic failure

e) The manufacture should provide both the 3D and 2D views of the proposed system in the technical bid, failing which technical bid is liable to be rejected

Schedule to Tender

Note:

1. Tenderers are advised to read carefully the Terms and Conditions of supply and "the Instructions to the Tenderers" before recording the rates in this schedule.
2. No erasures or overwriting shall be allowed, unless they are authenticated under the full signature and the seal of the tenderer.
3. The Rates shall be FOR, at destinations/godowns/places indicated in the delivery

Item no	Description of goods with details of specifications	Number / quantity	Price / Rate per Unit	Taxes	Duties	etc

Signature of the Tenderer

Date:

Seal of the Firm

National Centre for Nanoscience & Nanotechnology
University of Mumbai
(NCNNUM)

National Center for Nanoscience and Nanotechnology, Ramkrishna Bajaj Sanskrut Bhavan, II floor,
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Tender Document for

PLASMA ENHANCED CHEMICAL VAPOUR DEPOSITION (PECVD) CUM PLASMA POLYMERIZATION

No: NCNNUM/Tender/578/2013

Date: 22nd April 2013

Part B – Specifications

Specifications for Plasma Enhanced Chemical Vapour Deposition (PECVD) Cum Plasma Polymerization

1. System Description

Supply, installation and performance demonstration of Plasma Enhanced Chemical Vapour Deposition (PECVD) with necessary hardware and software at National Centre for Nanoscience & Nanotechnology, University of Mumbai. The thrust area using this system will be to produce thin and thick films of silicon nitride, silicon carbide, silicon-di-oxide and silicon with or without in-situ doping of Phosphorus for MEMS / NEMS applications. The vendor must provide detailed specifications of the infrastructural requirements for the PECVD system with the bid. Also the tender should provide the clear timeline by which the system will be built, inspected, shipped and installed. The system shall consists of following main units

a) Loading Cum Polymerization chamber.
b) Central Load Lock Chamber
c) Four quantities of PECVD chambers
d) Vacuum System
e) RF Electrode and power supply
f) Gas Management System
g) Electrical & Control System

2. Loading with Polymerization chamber

The Loading with polymerization chamber should consists of following :

2.1. Circular Chamber of suitable size made of non magnetic Stainless Steel Grade SS-304
2.2. Door for loading/unloading the substrate (Manually)
2.3. Support structure made of tubular mild steel and powder coated to house all the process chambers, Central load lock chamber and loading/unloading chamber
2.4. Sufficient number of ports with flanges
2.5. Round Substrate holder of approximately 125 mm dia to accommodate substrate of 100mm Diameter
2.6. Transport mechanism to transport the substrate from loading/unloading chamber to central load lock chamber and vice versa without breaking vacuum
2.7. View port for viewing the plasma
2.8. Rotatable work holder (speed 0 to ≥ 20 RPM)
2.9. The loading with polymerization chamber should able to form plasma assisted polymers deposition on the 4 inch substrate from the following types of monomers
   a. Hydrocarbons
   b. Hydrocarbons with polar groups
   c. Fluorocarbons
   d. Silicon containing monomers
   e. Metal containing plasma polymers

3. Central Load Lock Chamber

The Central Load Lock Chamber should consists of following

3.1. Circular Chamber of suitable size made of non magnetic Stainless Steel Grade SS-304
3.2. Support structure made of tubular mild steel and powder coated to house all the process chambers, Central load lock chamber and loading/unloading chamber
3.3. Sufficient number of ports with flanges
3.4. Round Substrate holder of approximately 125 mm dia to accommodate substrate of 100mm diameter

4. PECVD chamber- 4 Nos.

Support structure made of tubular mild steel and powder coated to house all the process chambers, Central load lock chamber and loading/unloading chamber should be provided by the supplier. The system consists of four quantities of PECVD Chamber and each PECVD chamber should consists of following

4.1. Circular Chamber of suitable size made of non magnetic Stainless Steel Grade SS-304.
4.2. Sufficient number of ports with flanges
4.3. Substrate Holder:
    4.3.1. Heater assembly for heating the substrate uniformly over the entire area upto 700° Celsius
    4.3.2. Temperature controller with RS 232 port and digital display of the set temperature and actual temperature. The temperature should be measured on the substrate surface and not inside the heater. Digital PID temperature controller unit should be capable of maintaining the set temperature with an accuracy of $\pm 1^0$C
    4.3.3. Substrate holder should be able to rotate during coating at a speed of 0 to 20 RPM
4.4. Transport mechanism for transferring the substrate from central load lock chamber to PECVD chamber or vice versa without breaking vacuum.
4.5. View port for viewing the plasma
4.6. Suitable ports compatible for future addition of in-situ/online measurement tools such as ellipsometer or interferometer
4.7. The process requirements for the PECVD chambers are as follows
    a) One PECVD chamber for Silicon nitride deposition
    b) One PECVD chamber for Silicon carbide deposition
    c) One PECVD chamber for Silicon-di-oxide deposition
    d) One PECVD chamber for Polysilicon deposition with or without phosphorus doping (10^{20} atoms / cm^3)

5. Vacuum System

The ultimate vacuum that can be achieved in clean, cold, empty, dry de-gassed chamber is ~5 x 10^{-7} m bar or better.

Pumps

5.1. Turbo molecular pump having pumping speed of 400 ltrs/sec or more with controller for Central load lock chamber
5.2. The pumps shall be air cooled or water cooled
5.3. Oil free dry Scroll Pump of required capacity for backing Turbo pump

4 Nos oil free dry Scroll Pump of required capacity for all PECVD process chambers. The pump should be capable of working in environment like Oxygen, Nitrogen, Silane, Phosphine and Methane gases.

5.4. Additional oil free dry Scroll Pump for plasma polymerization chamber

5.5. All the pump should meet international norms for noise and vibration. The noise level shall be ≤ 60 db for individual pumps.

5.6. Vacuum lines made of stainless steel, fitted with bellow adopter wherever necessary to arrest the vibration. All the vacuum lines fittings are argon arc welded using TIG welding technique and all the pipelines are leak tested using Helium Mass Spectrometer Leak Detector to a leak rate of 1×10^{-9} m.bar lit/sec

Vacuum line accessories

5.7. Motorised Throttle Valve 4 Nos. of suitable size on the roughing line to maintain vacuum level on all PECVD chambers

5.8. Suitable roughing and backing valve for central chamber.

5.9. Solenoid operated vent valve to break the vacuum at the end of the process either by admitting atmospheric air or by connecting dry nitrogen/argon gas source, one for each chamber.

5.10. High vacuum valve of suitable size to isolate the chamber from the turbo molecular pump-for central chamber.

5.11. Gate valve of suitable size between process chambers and Central load lock chamber

5.12. All valves should conform to the leak rate of 10^{-9} mbar l/sec. The material used for construction of the valve should be of SS 304L or any other equivalent stainless steel with viton seals. In the event of power failure the high vacuum valves should close automatically.

6. Vacuum Measurement

The system is to have low vacuum gauges and high vacuum gauges and the details are given below. The gauge controllers for the gauges and the gauges should be calibrated against national standards. All the gauges should be interfaced with PC via RS232 or USB or Ethernet or equivalent.

6.1. Capacitance Manometer for vacuum measurement with controller and necessary cables, measuring range 10 to 10^{-3} mbar for all PECVD chambers

6.2. Pirani Gauge with measuring range upto 10^{-3} mbar for loading chamber, central load lock chamber and turbo backing.

6.3. Penning Gauge with measuring range 10^{-2} to 10^{-9} mbar for measuring turbo high vacuum.

7. RF Electrode and power Supply

7.1. **One** RF Power Supply, 13.56 MHz frequency, 600 Watts with auto matching network with forward & reflected power monitoring along with the necessary cables for **all** PECVD **chambers** and plasma polymerization chamber. Power supply should be of reputed make such as SEREN/AE/HUTTINGER/COMDEL

7.2. Shower type RF Electrode of suitable size mounted from the bottom of the chamber capable of adjustment from 10 to 50mm w.r.t substrate holder

8. Gas Management System

8.1. Mass Flow Controller (MFC) should be calibrated / designed for following gasses

a) Hydrogen (0-200 SCCM) – 4 Nos (all PECVD chambers)
b) Silane (0-50 SCCM) – 4 Nos (all PECVD chambers)
c) Silane / phosphine mixture (0-50 SCCM) – 1 No (Polysilicon chamber)
d) Methane (0-50 SCCM) – 1 No (Silicon carbide chamber)
e) Ammonia (0-100 SCCM) – 1 No (Silicon nitride chamber)
f) Nitrous Oxide N_2O (0-50 SCCM) – 1 No (Silicon Di oxide chamber)
g) Argon (0-200 SCCM) - 1 No (Carrier for Plasma Polymerization chamber if monomer is in liquid form)
h) Vinylidene Fluoride (0-200 SCCM) – 1 No (Plasma Polymerization chamber)
i) Organo metal compound (0-200 SCCM) -1 No (Plasma Polymerization chamber)

8.2. Necessary solenoid valves, gas valves, needle valves should be provided. Maximum pipe line length will be 10 to 12 feet for each gas line.

8.3. Tank of suitable capacity to be provided for liquid type monomers

8.4. All the Mass Flow Controllers shall be interfaced to PC via RS232 or equivalent.

9. Instrumentation and Control System

9.1 Major equipment should be controllable through a computer interface.

9.2 Computer control with real time data acquisition. Software to define and save recipes, should be provided by the supplier. Logging of process parameters (temperatures, pressures) during deposition

9.3. All system parameters should be recorded in the computer and ready for easy retrieval when needed

9.4 Control Console is fabricated out of Mild Steel neatly powder coated with panel cooler is placed by the side of chamber frame structure is provided to house all the Electrical Control Instrumentation and Control Switches which houses the following:

a) Programmable Logic Controller
b) Substrate heater controller
c) Mass Flow Gas Controllers display
d) Vacuum gauge indicators
e) Pump control unit status
f) Mains Control with RYB Indications and Isolator Switch
g) Turbo Pump Controllers
h) RF Power Supplies
i) Touch screen PC

9.5 All the electrical switchgears like Control Transformer, Contactors, Relays, Fuses, Timers etc are mounted on a plate and fitted vertically for the convenience of maintenance

9.6 The control console is wired to operate on 415 V AC, 50 Hz, 3 Phase Power Supply.

9.7 The PECVD system should consist of a centralized control system interfacing the input power module, utilities, all sub-systems of PECVD, process control module through a suitable PLC system.

9.9 Programmable Logic Controller (PLC) shall be provided in the system for complete automation of vacuum cycle, deposition cycle and to achieve various interlocks of the

system. This PLC will have necessary number of inputs and outputs, communication interface module etc.

9.10 The supplier should provide a CD containing the ladder logic or equivalent PLC programme used for the instrumentation of the PECVD system and a CD containing the software for PLC programming.

9.11 Operator Control Station is a PC with Touch screen with Colour Monitor of reputed Make.

9.12 In case of sudden power failures, suitable protective devices should be provided in all electrical / electronic systems to prevent damages to the critical / sensitive systems of the PECVD system.

10. Deliverable Documents, Tool-kits and Spare Parts

10.1 All documentation shall be in English language. In addition to the hard copies, soft copies of the manuals shall be submitted vide – CD.

a) System Operational Manual in print and CD
b) System Maintenance Manual in print and CD. A discussion of common symptoms of mal function / failure and the remedial measures to be adopted in each case should be discussed in details in the maintenance manual supplied with the systems.
c) Calibration Procedure Manual in print and CD
d) Complete set of Service Manuals for all OEM products
e) Complete set of Engineering Drawings in print, pdf and original CAD format in CD
f) Detailed circuit schematics and description of all the electrical / electronic circuit system
g) Test Reports

10.2 A set of spare O-rings and other essential spares to be provided.

10.3 A set of fuses and essential spares for turbo and rotary pumps, gauges, RF power supply and gas handling system to be provided.

10.4 Complete set of tool-kits for maintenance of PECVD system

10.5 Complete set of took-kits for vacuum-pumps and compressors

10.6 Complete sets of spare parts including (if appropriate)

a) Gaskets for every port
b) Turbo pump lubricant

11. Installation and Training

11.1 The complete system along with accessories specified in Part B of this tender document must be installed at National Center for Nanoscience and Nanotechnology within 4 months from purchase order.

11.2 The supplier / manufacturer must provide qualified instructor(s) to train NCNNUM research staff on the use of Plasma Enhanced Chemical Vapour Deposition (PECVD) Cum Plasma Polymerization Unit and its accessories

11.3 The supplier / manufacturer must provide training for the operation, trouble-shooting and maintenance complete system.

11.4 Vendor should provide pre-shipment inspection training at the manufacture site for one working week for two persons. All costs like to & fro travel, boarding and lodging should paid by the vendor

11.5 Warranty: Two year from installation and acceptance.

11.6 Supplier shall provide two full time technical operators for machine operation and maintenance for a period of one year from the date of Installation and acceptance.

12. Acceptance and Completion

12.1 The supplier shall install and commission all the accessories covered under the Part B of this tender and demonstrate performance and quality parameters of the complete system as per design. NCNNUM Personnel shall witness the performance tests.

12.2 Leak testing of the chamber and its sub-assemblies (if any) to an individual leak rate of $1x10^{-9}$ mbar ltrs/sec using Helium Mass Spectrometer Leak Detector.

12.3 Testing of ultimate vacuum of 1×10^{-6} m.bar in clean, cold, empty thoroughly degassed condition in Process Chamber

12.4 Testing of Manual/automatic operation of vacuum system from cold start to vacuum ready indication

12.5 Testing safety interlocks functions

12.6 The supplier shall demonstrate the growth of 2μm thick silicon nitride, silicon-di-oxide and Silicon Carbide on the 4 inch substrate

12.7. The supplier shall demonstrate the growth of 2μm thick silicon on the 4 inch substrate without doping and with doping of phosphorus to the level of $> 10^{20}$ $/cm^3$.

12.8 The supplier shall demonstrate the deposition of 2μm thick of PVDF polymer

12.9 The supplier should demonstrate $\pm$3% thickness uniformity on a 4 inch substrate, excluding 5 mm edges.

13. Optional Accessories / Modules

The following accessories (Residual Gas Analyzer for all process chambers, Exhaust System) should be quoted separately

13.1 Residual Gas Analyzer

13.1.1. Quadruple Mass spectrometer type residual gas analyzer shall be integrated with the PECVD system.

13.1.2. Residual Gas Analyzer should be capable of detecting atomic mass number (amu) from 1 to ≥200

13.1.3 C based software for data acquisition as well as online monitoring of residual gas shall be provided.

13.1.4 Reputed make RGA with in built Turbo based vacuum system to be provided, that will be used sequentially for monitoring residual gases in any or all chambers.

13.2. Chiller

13.2.1 Chiller for chilled water supply for closed loop circulation.

13.2.2. The capacity of chiller should be suitable to the PECVD system

13.3. Air Compressor and Spare Accessories

13.3.1 Air compressor with ≥ 100 litre storage tank and pressure regulator shall be quoted

13.3.2 The noise level of the air compressor should be less than 45 db

13.3.3 Spare (2 Nos) oil free dry Scroll Pump along with gate valve as well as spare (2 Nos) turbo molecular pump with pump controllers and gate valve should be quoted as optional

13.3.4 Spare (2 Nos) Pirani gauge (range upto 10^{-3}mbar) and Spare (2 Nos) Penning Gauge (measuring range 10^{-2} to 10^{-9} mbar). Both the gauges should have individual digital display units as well as interfaceable with PC via RS232 or USB or equivalent

13.3.5 One additional RF power source and RF electrode as mentioned in section 7 shall be quoted as optional spare

13.3.6 A spare heater assembly along with temperature controller having RS232 or equivalent interface as specified in section 4.3 needs be quoted as optional spare.

13.3.7 A spare PLC along with PC and touch screen display should be quoted as optional spare.

13.4. Optional MFC's

a) Acetylene (0-200 SCCM) - 1 No (Plasma Polymerization chamber)
b) Acrylonitrile C_3H_3N (0-200 SCCM) – 1 No (Plasma Polymerization chamber)
c) Hexamethyl disil oxane-HMDSO (0-200 SCCM) – 1 No (Plasma Polymerization chamber)
d) Carbon-di-oxide (20 sccm) – 1 No
e) All MFC should have interface option with PC via RS232 or equivalent

13.5 Gas Cylinders, regulators, detectors and Scrubber system

The vendor should quote for Gas cylinders, regulators, detectors and scrubber system as specified below including the installation of the same at National Centre for Nanoscience and Nanotechnology, University of Mumbai.

13.5.1 Along with the system supplier shall provide electronic grade high purity cylinder for each gas. Technical Specs for specialty gases along with the type of connectivity and purity level are given below:

Name of the gas	Purity	Cylinder connectivity	No. of Cylinders
Hydrogen	99.9999 (N6)	DISS 724 or equivalent Compatible regulators	1
Silane (SiH_4)	99.999 (N5)	DISS 632 or equivalent Compatible regulators	1
1% Phosphine (PH_3) in Silane (SiH_4)	5N5/6N	DISS 632 or equivalent Compatible regulators	1
Methane (CH_4)	99.999 (N5)	CGA 350 or equivalent Compatible regulators	1
Ammonia (NH_3)	99.9995 (N5.5)	CGA 660/720 or equivalent Compatible regulators	1
Nitrous Oxide (N_2O)	High Purity	Compatible regulators	1
Argon (Ar)	99.999 (N5)	CGA 580 or equivalent Compatible regulators	1
Vinylidine Fluoride (VDF)	High Purity	Compatible regulators	1
Acetylene	High Purity	Compatible regulators	1

13.5.2 Proper regulators should be supplied for each gases mentioned above:

13.5.2.1 Regulators should be Single stage
13.5.2.2 Approx. delivery pressure range of 2-100 psig (0.14 – 7 bar)
13.5.2.3 Source Pressure : Vacuum to 3500 psig (241 bar)
13.5.2.4 Inlet/Outlet Connections : ¼ inch face seal
13.5.2.5 Surface Finish : 15 µin – 25 µin Ra
13.5.2.6 Material : SS316L
13.5.2.7 All port (6 port) ¼" male VCR
13.5.2.8 316L SS Diaphragm Valves for outlet & purging with ¼" mail VCR

13.5.3 Suitable Gas detectors should be supplied along with gas cylinders:

13.5.3.1 Gas detectors for all flammable (SiH_4, CH_4, H_2…) and toxic gases (PH_3, NH_3, N_2O….)
13.5.3.2 The detector should be connected to remote gas monitor with alarm facility
13.5.3.3 Monitoring Configuration: Continuous, single point, extractive
13.5.3.4 Detection level in ppm
13.5.3.5 The vendor must provide at least a two-channel sensor unit for detection of each gases. One sensor is to be mounted near the gas cylinder, the second sensor is to be mounted in proximity of the system
13.5.3.6 For flammable gases Sensor details, measuring range, limit of sensor : Range 0 - 100% LEL,Detection level in ppm
13.5.3.7 Type – catalytic, Output - 4 to 20 mA , Input supply - 24 VDC , Sensor body SS-316, Enclosure – Flame proof
13.5.3.8 Display – 10 LED bar graph per channel , Module Card - Microcontroller based, Programming : 4 magic button , Input - 4- 20 mA , Buzzer - 90db+ Power – 220V, 50 Hz, working temp: 15 - 40 degree centigrade . Make: Alfa Level / ABB/ PRISM Etc of good quality.

13.5.4 Scrubber System:

13.5.4.1 Tenderer should provide and install suitable scrubber system for the gases specified in section 8.1
13.5.4.2 The capacity of the scrubber system should be suitable for gases specified in section 8.1
13.5.4.3 Dry standalone scrubber should be provided compatible to clean room.

13.6 Vacuum Deposition Systems

Following two independent Vacuum Deposition System shall be quoted as optional items

13.6.1. Bench top sputter system

13.6.1.1.Chamber: The working chamber material should be made up of Borosilicate glass with acrylic implosion guard or better transparent as

well as implosion guard. The diameter of the chamber shall be ≥ 150 mm and height shall be ≥ 110 mm. This bench top sputter system should be used for the sample preparation for Scanning Electron Microscopy (SEM). The sample could be obtained from the system described in section 1. If required, suitable cooling system should be provided by the vendor.

13.6.1.2. Work holder: The work holder should be ≥ 100 mm diameter. Atleast 6 quantities each of SEM Stub holes, 10 mm dia and approx 3 mm dia holes.

13.6.1.3. Vacuum System and Gauges: Rotary and Turbo pump should be quoted along with suitable valves and gauges such as Pirani (range upto 10^{-3} mbar) and Penning Gauge (measuring range 10^{-2} to 10^{-9} mbar). Both the gauges should have individual digital display units as well as interfaceable with PC via RS232 or USB or equivalent. One spare set of Pirani and Penning gauge should be quoted separately.

13.6.1.4. Targets and accessories: Two quantities each of Gold target and Chromium target. Other targets such as platinum, copper and iron shall be quoted as optional accessories. Carbon evaporation accessory for the production of carbon films for Transmission Electron Microscopy (TEM) shall be quoted. Digital Film Thickness Monitor (with RS232 or USB or equivalent interface) along with accessories (oscillator kit & crystal). Necessary power supply unit along with controls and display units needs to be provided.

13.6.2. Multifunctional Vacuum Deposition System

13.6.2.1 Chamber: A multi functional vacuum coating system can be proposed as an optional item. It contains a single stainless steel SS304L chamber having inner side dimension ≥ 500mm (D), ≥ 500mm (D) and ≥ 600mm (H). A hinge supported door for closing (or) opening the chamber with ≥ 2 nos of view ports. The base plate should have minimum of 11 feedthrough ports. Top of the chamber should be provided with ports with flanges required for mounting substrate, rotary work holder support, substrate heater feedthrough, Quartz crystal sensor feedthrough, necessary ports for evacuation, measuring gauge heads. Suitable support structure for the Chamber should be provided by the vendor. Ultimate vacuum of approx 5×10^{-7} mbar should be achieved in clean, cold, empty degassed chamber.

13.6.2.2 Substrate Holder: Rotary substrate holder which can hold the different sized substrates up to 6 inch. The rotation should be controllable between 20 – 60 rpm. Substrate heaters for heating upto 250^0C to be provided along with Digital PID Controller (with RS 232 or USB interface) and suitable thermocouple. Electrically operated source shutters shall be provided. Al, Cu and W target material should be provided by the vendor.

13.6.2.3 Chamber Gadgetories: L.T Source & Power supply capable of delivering upto 200 amps at 10 volt. Electron beam gun & power supply capable of delivering upto 3kW – four pocket electron beam source with X-Y sweep coils. H.T electrodes, water feedthrough, detachable type filament assembly along with ≥ 3 kW electron beam tetrode power supply with X-Y beam scan facility should be provided. Magnetron source (≥ 3 inch) should be RF/DC & pulsed DC compatible. The magnetron source should be configured for upward sputtering. Ion beam source with power supply, End Hall Permanent magnet Ion source package with mass flow controller for Ar or Oxygen. Electrically operated source shutters for Electron Beam Gn and LT source should be provided. RF power source (≥ 300 Watt) with auto matching network to be provided for RF sputtering. A DC power supply capable of delivering upto 2 kW for DC sputtering. Necessary display units with RS232 interface for all power supply needs to be provided. Digital Film Thickness Monitor (with RS232 or equivalent interface) along with accessories (oscillator kit & crystal) should be provided for monitoring deposition rate and thickness. The deposition monitor should be interfacable with the operation of shutter.

13.6.2.4 Vacuum System and Gauges: Dry pump (≥ 35 m^3/hr) and Turbo pump (≥1000 ltrs/sec) should be quoted along with suitable valves and gauges such as Pirani (range upto 10^{-3}mbar) and Penning Gauge (measuring range 10^{-2} to 10^{-9} mbar). Both the gauges should have individual digital display units as well as interfaceable with PC via RS232 or equivalent. One spare set of Pirani and Penning gauge should be quoted separately. Electro pneumatically operated isolation valves for both roughing and backing purposes. This valve operation should be interlocked with the high vacuum valve and vent valve. An electro pneumatically operated air admittance valve should be provided to break the vacuum at the end of the cycle to expose the substrate to atmosphere. Mass flow controller (2 to 100 sccm) with filter, valve and an inlet solenoid valve to feed gas into the chamber to carry out sputtering operation using Ar and Oxygen.

13.6.2.5 Control System: PLC / PC based instrumentation system should be provided for controlling the substrate heater, rotary drive, Electron Beam Gun power supply, Magnetron power supply, Ion beam gun power supply, Thyristor controller, System emergency OFF switch and thickness monitor.

Sd/-
Director,
NCNNUM,
University of Mumbai

Annexure 'A' – Format for submitting un-priced BOQ along with technical bid

S No.	Description	Qty	Make / Model

Signature of the Tenderer

Date:

Seal of the Firm

Annexure ‘B’ – Format for submitting compliance/response of bidder

With reference to the technical details described in different sections of Part B, the bidder shall provide their compliance/response as below format.

Section Number	Nomenclature	Bidder’s Compliance / Response
1	System Description	
2	Loading with Polymerization chamber	
3	Central Load Lock Chamber	
4	PECVD chamber	
5	Vacuum System	
6	Vacuum Measurement	
7	RF Electrode and power Supply	
8	Gas Management System	
9	Instrumentation and Control System	
10	Deliverable Documents, Tool-kits and Spare Parts	
11	Optional Accessories	
12	Installation and Training	
13	Acceptance and Completion	
14	Annexure ‘A’ –Un-priced BOQ along with technical bid	
15	3D and 2D views of the proposed system is enclosed	

If the tenderer specification has **any deviations** from the specifications or details provided in any of the sections described in Part B needs to be clearly specified in the above table.

Signature of the Tenderer

Date:

Seal of the Firm