INSTITUTE OF PHYSICS,
SAINIK SCHOOL, BHUBANESWAR
(An autonomous Research Institute of Dept. of Atomic Energy, Govt. of India)

GLOBAL TENDER ENQUIRY

Last date for submission of tender: 31st January'2008 up to 15.00 Hrs.

The Institute intends to procure the following items:

1. Single Unit consisting of Field Emission Gun Scanning Electron Microscope and Focused Ion Beam system, with Accessories **(FEGSEM - FIB).-** 01 Set (against Two Bid format (Technical & Financial separately)):

2. 5 - Axes Sample Manipulator; Chamber & Accessories - 01 set (single bid format)

For detail specifications, terms & conditions please visit our website, http://www.iopb.res.in.

DIRECTOR

GLOBAL TENDER NOTICE No. - 01 / 2007 FOR PROCUREMENT OF:

1. *SINGLE UNIT CONSISTING OF* FIELD *EMISSION GUN SCANNING ELECTRON MICROSCOPE AND FOCUSED ION BEAM SYSTEM (FEGSEM – FIB) – 1 UNIT*

2. *5 – AXES SAMPLE MANIPULATOR; CHAMBER & ACCESSORIES – 01 UNIT*

Last date for submission of the Tender: --31st January, 2008

For item (1): FEGSEM – FIB, sealed quotations in **two parts** superscribed with tender name & number as mentioned above are invited from reputed overseas manufacturers / Indian vendors as per following mode:

Part-I will consist of the techno commercial bid

And

Part- II will consist of the Price bid.

Offer for the above tender will be received by the undersigned till 15 hrs. on 31st January'2008. The techno commercial bid (Part- I) will be opened thereafter in presence of the intending bidders. The Price bid (Part-II) of only the technically qualified bidders will be opened on later date with due information.

The techno – commercial bid should also have a compliance statement against the detailed specifications. Queries related to the technical specifications may be addressed to: Dr. P. V. Satyam, email: satyam@iopb.res.in

For item (2): (A) 5-axis sample manipulator; (B) chamber, accessories: Sealed quotation superscribed with tender name & number as mentioned above are invited from the overseas manufacturers / Indian vendors in a single bid format. Interested parties may quote either for 2(A) or 2(B) or both together. Offer for this tender will be received by the undersigned till 15 hrs. on 31st January, 2008.

The bid should also have a compliance statement against detailed specifications. Queries related to the technical specifications may be addressed to Dr. T. Som, email: tsom@iopb.res.in

The Institute reserves the right to accept / reject any or all offers in full / part thereof without assigning any reason thereof.

DIRECTOR

Part- I: Technical Specifications

The details mentioned below are the minimum required specifications. Systems with better specifications are also urged to include as separate quotes by the manufacturers/vendors.

SINGLE UNIT CONSISTING OF FIELD EMISSION GUN SCANNING ELECTRON MICROSCOPE AND FOCUSED ION BEAM SYSTEM (FEGSEM – FIB) – 1 UNIT

(1) FEGSEM:

(a) Resolution: ≤ 1.2 nm in SE mode @ 30 kV

≤ 1.0 nm in STEM mode @30 kV (High Vac.)

Optional: Low Vacuum(LV) and Extended Low Vacuum (ELV)modes

≤ 1.5 nm @30 kV (SE – LV) and ≤ 1.5 nm @30 kV (SE – ELV)

(Details of resolution in all possible configurations needs to be mentioned)

(Mention resolution at optimum working distance and coincident point)

(b) SEM probe current: 5 pA – 20 nA; higher currents preferred during lithography process.

(c) SEM Accelerating Voltage: 0.2 kV – ≥ 30 kV

(d) SEM emitter: Schottky Field Emitter (mention life time)

(e) Detectors:

SE (High efficiency Annular Type) or equivalent for high resolution type

ET type (SED)

Energy Dispersive X-ray Detector (Si(Li))

Optional: STEM – Multimode BF/DF detector

Energy Dispersive X-ray Detector (Silicon Drifted - LN_2 free)

(Either Si(li) or SDD would be procured)

BSD – solid state of scintillation type;

Low – Vaccum SED (Optional)

Gaseous SED (in Extended Low Vac. Mode)

(Mention if any other detectors are provided)

(f) Specimen Stage: 5 or 6 axis Eucentric, all motorized stage;

X = ≥ 50 mm, Y = ≥ 50 mm and Z = ≥ 25 mm, Tilt: -10 ° to 60º (or better); R = 360º; (Mention the resolution, i.e., the minimum step size, in each case)

Software temperature control for optional heating and cooling stages.

Cooling stage (Optional) and Heating stage (Optional)

(g) *Magnificiation:* 50× to ≥ 750 k

(h) Vacuum Control: Fully automatic, with automatically operated pneumatic column isolation valve. Manual override switch for maintenance.

(h) *Specimen Chamber:* High Vacuum $\leq 7 \times 10^{-4}$ Pa;

IR CCD – camera for sample viewing

Electron and Ion beam current measurements

Extra free port(s) for further up-gradation to do transport measurements (like 4-probe)

Optional: Low – vacuum: 10 to 125 Pa; Extended Low – Vac: 10 to 3500 Pa

Pump Down Time: ≤ 5 minutes;

Fast sample transfer; Seamless transition between high vacuum and low vacuum;

(i) Beam blanker: Built-in blanking system, vacuum feed-through, electronic switch box, power supply and control rack. Designed for dedicated E-beam lithography and related applications.

(2) FIB system:

(a) *Resolution:* ≤ 7 nm at 30 kV; Mention optimal working distance.

(b) *Probe current:* 1 pA – ≥ 20 nA in steps (higher currents ≥50 nA are desirable)

(c) *Accelerating voltage:* ≤ 5.0 keV – 30.0 kV (variable in 100 V steps or continuous)

(Lower starting voltage, ≤ 2.0 kV would be preferred)

(d) Emitter: Ga liquid metal ion source (LMIS)

(e) Source Life time: ≥ 1000 hours

(f) Magnification: 50× - 500 k× (or better)

(g) Beam blanker: External control

(h) Charge neutralization for milling non-conductive samples

(i) Milling rates: – give details with examples

(j) Detectors: Secondary ion detector ***(Optional)***

(3) Data Acquisition and Control/ Digital Image Processing:

Dwell time: 50 ns to 25 ms (adjustable in case of beam scan capabilities);

Image resolution: Up to 3k × 2k (or better);

Single frame or 4-quadrant image display; 4 – quadrant – live;

Frame averaging, continuous averaging, pixel averaging, movie recorder

TFT or LCD monitors

Movie recorder (Digital video recording)

System control: Integrated control system for both SEM and FIB; Windows XP based. Optical mouse, keyboard; Support PC and DVD R/W; Multifunctional control panel; Joystick for stage control; high quality printer, high quality scanner; On-line data analysis package; Off-line analysis license (one extra, if any). Additional external storage (≥ 120 GB) for backup purpose. Quantitative analysis package for data analysis (like particle size analysis, texture or 3D reconstruction) needed to be included.

(4) In-situ deposition schemes: Gas Injection System (GIS)

a. Individual gas injectors with separate injection systems
b. ≤ 5μm placing accuracy without user interaction
c. GIS control available for automation
d. 5 (five) gas injectors for enhanced etch or deposition

- Platinum deposition;
- SiO2 deposition;
- Enhanced Metal Etch;
- Enhanced SiO2 etch;
- Gold metal deposition;
- Empty crucibles for user supplied materials

(5) **Manipulator for TEM – Lift out process (for automated TEM specimen preparation)** (Needle movement accuracy: 0.2 μm, Manual and Graphical User Interface; Other details about the manipulator may be given)

(6) External Scan Input Panel Kit

External interface enabling external control of the SEM scanning system, with video out connections for the detector signal

(7) Multi-Purpose Sample Holder

Quick-fit sample holder specially designed to hold those larger irregular samples.

Cross-section SEM sample module.

(8) **LITHOGRAPHY SYSTEM: Inbuilt facility or with the external hardware (for both ion and e-beam) hardware and Software for advanced patterning (clearly mention if this is from any third party): If digital pattern generator scheme is available (integration with CAD support) , details should be mentioned about the capabilities.**

Hardware:

TTL - blanking signal output

TTL - SEM/FIB external scan enable/disable

TTL signal for FIB/SEM external beam control request

Additional DAC per channel for scaling, rotation / orthogonally and shift

(for hardware alignment and hardware calibration)

Software:

Hierarchical fully integrated layout editor/viewer.

Data import for DXF, CIF and ASCII data

Directly imported BMP/TIFF for 3D milling

Exposure parameter adjustment and calculation.

Macro generation

Digital image acquisition

Line width measurement capabilities

SEM/FIB remote control and FIB module

Off line license

(9) Energy Dispersive System for X-ray Analysis

Carry out qualitative and quantitative analysis from an area on a specimen excited by the electron beam with low count rate – Si(Li) detector based or with high count rates with silicon drift detector. Quote high count rate SDD (LN_2 free) as an optional item.

Acquire elemental maps and line-scans.

Quantitative data analysis: like composition analysis

Exporting/printing

Energy resolution: 134 eV or better at MnKα

Standards reference data/ samples

(10)In-built active vibration isolation system

(11)Electron Backscattered Diffraction (EBSD)(Optional)/ Texture Analysis package (Optional)

(12)Secondary Ion Detector - Optional

(13)Sample loader system for fast sample transfer – Optional

Other System Options:

a. Deposition and milling of lines, boxes, open boxes, polygons, circles, cross-section and cleaning cross-section
b. Serial sectioning and/or multi-site automation software
c. Directly imported BMP/TIFF for 3D milling
d. Serial sectioning automation
e. Automated multi-slice
f. Automated software for unattended TEM sample preparation
g. 3D reconstruction
h. Detailed image analysis software
i. Specimen holder kit and TEM specimen holder kit
j. Compressor – chiller unit – specify air cooled or water cooled compressor
k. UPS (chiller and main system with 1 hour backup)

PART- II – COMMERCIAL TERMS & CONDITIONS FOR ITEM No.-1

1. **Price**: The price required to be quoted on Ex-works (inclusive of necessary export packing cost). This does not include the applicable duties & taxes. The price quoted in the tender required to be quoted in ink, both in figures & words. In case of any discrepancy, the rate quoted in figures will be accepted.
2. **Price Validity:** - The price validity of the system should not be less than six months from the date of opening of the tender.

3. **Specification and quantity: -** The specification as well as the configuration and quantity of the equipment are required to be strictly as per the requirement of the indenter.
4. **Payment:** - The payment will be made against letter of credit (L/C). 90% of the L/C value will be released against successful delivery of the consignment at IOP site and balance 10% will be released after successful installation, commissioning of the system against submission of performance bank guarantee of equivalent amount valid for the entire warranty period. The bank guarantee required to be issued by a nationalized bank.
5. **Delivery: -** The delivery of the system is required to be made within **25 weeks** from the date of establishment of L/C.
6. **Bank charges: -** The bank charges inside India to the applicant account and outside India to the beneficiary account.
7. **Warranty: -** The system required to be warranted against manufacturing and functional defects for **5 years** from the date of completion of installation, commissioning.
8. **Training: -** The free training for one week for two scientists of the Institute is to be imparted at principal's factory within the warranty period. The to and fro airfare as well as the lodging, boarding and the local transport etc. are to the supplier account.
9. **Pre-inspection**: - The experts of the Institute or any agent duly authorized by the Institute may carry out a pre-delivery inspection. The to and fro airfare as well as the lodging, boarding and the local transport etc. are to the supplier account.
10. **Operational Manual**: You are required to supply the operational manual of the equipment, service manual with circuitry diagrams (hard copies and soft copies) etc. written in English only along with the consignment.
11. **Liquidated damage**: -The liquidated damage is to be collected @ 0.5% of the total value per delayed week or part thereof or 5% (aggregate) of the total order value if such case arises.
12. **Installation: -** You will carry out the installation of the system at our site (Institute of Physics, Bhubaneswar) with your instruments, accessories, tools & tackles; deploying appropriate manpower as required, at your cost.
13. **Testing: -** You are required to test all the technical specifications of the equipments. The testing equipments, manpower, along with the consumables as required for testing the system will have to be arranged by you at your cost.

14. **Supply of spares:** Supply of spares should be ensured for at least for 10 years from the date of supply.
15. **Experience**: Details of the client list for supplying similar type of instruments are to be submitted along with installation certificate of the same.
16. **Agent:** An Indian agent, who will participate in this Tender on behalf of one manufacturer, will not be eligible to present another manufacturer.

DIRECTOR

Item No. 2: 5-AXES SAMPLE MANIPULATOR; CHAMBER AND ACCESSORIES- 01 Unit

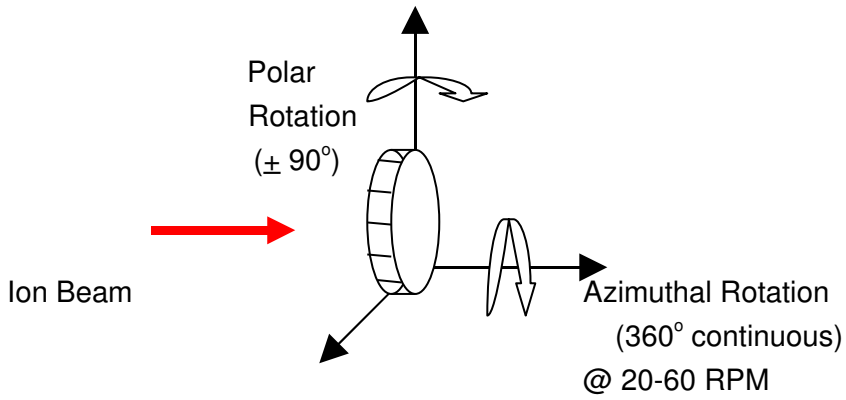
(A) 5-axes sample manipulator:

Orientation: Vertical
Base flange: 8 inch OD

X-Y movement: ±12.5 mm (precision of 1 mm)
Z movement: 50 mm (precision of 1 mm)
Sample tilt: NIL

5-axes stepper motor controller for rotational and translational movements with computer interfacing provision should be quoted

Sample rotational motions: Motorized **polar rotational movement** of the sample is required with a precision of 0.5°. It should be free from any backlash. We also want continuous **azimuthal rotation** from 0 – 360° @ 20 – 60 RPM. One should be able to interface them.



Sample holder / Plate size: Circular and should be compatible to make the best use of the X, Y, and Z movements. The metallic holder should have holes and clip arrangement to accommodate multiple samples having following dimensions

Sample size and thickness (to be used for experiments): Typically 1×1 cm^2 & 0.5–1 mm

Material for the sample holder should be clearly mentioned. It should be nonmagnetic and highly conducting material (both electrically and thermally). One spare sample holder (along with holes, clips to hold samples, etc.) should be supplied as an integral part of the consignment. The exact design should be finalized in consultation with the indenter only.

Sample surface should coincide with the centre axis and the centre of the manipulator should be at the chamber centre. The heights of all ports should be adjusted accordingly to avoid any chance of having any height mismatch. This should be very clearly mentioned in the quotation

Beam should always fall on the target even when high polar tilt is going to be applied

Sample cooling: Sample needs to be water cooled (through the holder) because of high ion current. Provision for LN2 cooling may be quoted as an optional item

Sample heating: Up to 500°C (minimum step by which temperature can be raised and stability in set temperature should be mentioned clearly). Reference point should be clearly mentioned (i.e. with respect to which point). Digital temperature display should be available through the temperature controller and it should be provided as an integral accessory of the manipulator

Target current: Provision for measuring target current during ion irradiation (for which the manipulator will be used) should be clearly mentioned. **There should be a specific mention about the current measurement facility during high temperature irradiations.** This Faraday cup assembly (provision for measuring the current from the samples those are going to be fixed on the sample holder) and a current meter should be quoted as an integral part of the sample manipulator

Suppressor: A secondary electron suppressor (metallic) before the sample manipulator is needed. This is required to suppress the ion induced emission of the secondary electrons from the surface of the samples under analysis. Therefore, around -150 Volt (maximum) may be required to be supplied to this. It should be preferably designed as a part of the sample manipulator such that it always remains fixed with respect to the beam and should not hinder the ions to fall on the sample during any kind of lateral or rotational motion. There should be provision of electrical connector attached to it

Manual: You are required to supply the latest operational manual of the equipment, service manual with circuitry diagrams (hard copies and soft copies) written in English along with the consignment.

(B) Chamber and accessories:

Main chamber: 12 inch diameter SS304 spherical chamber whose top port has to mate to the sample manipulator (goniometer) described above. Chamber vacuum will be maintained ~1×10^{-7} mbar. The chamber should be a equipped with a manually operated shutter (before the manipulator), which may be mounted on a suitable port

Load lock chamber: SS304 made standard load lock chamber with CF flanges. It should have a DN100CFF main pumping port and two DN40CFF ports. Viton sealed quick access door. However, the isolation/gate valve (DN63CFF) between the load lock chamber and the main chamber will be provided by the user. The load lock port should be clearly defined with respect to the beam entrance port (through schematic diagram or in words)

Sample transfer system: Magnetically coupled linear rotary feedthrough for sample transfer. It has to mate with transfer fork in part-A (i.e. the sample manipulator)

Ports: DN160CFF main pumping port (chamber bottom), two DN40CF ports, two DN40CFF ports each equipped with one BNC, one MHV, and one SHV vacuum compatible connectors, one DN100CF View Port (UV & X-ray resistant) at 45º (with respect to the beam entrance port), one ion source mounting flange (4½ inch (NW63CF) – 6 inch (NW100CF), which needs to be finalized before fabrication)

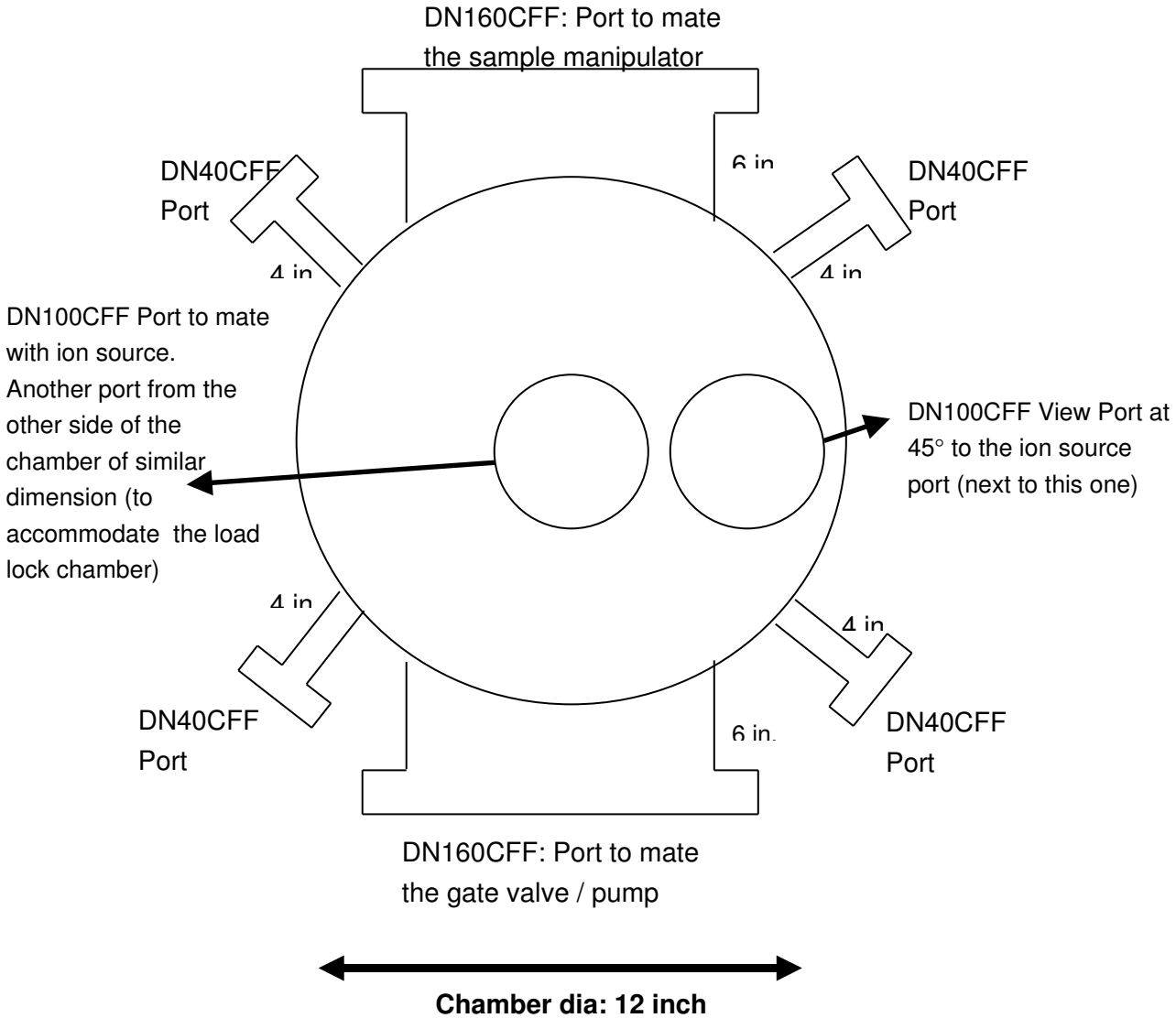
The number of ports, their dimensions, and type (like CFF/ISO/NEC) etc. should strictly comply with our requirements

The chamber should be electro polished in compliance with normal UHV standards, leak checked and certified leak free. The ultimate vacuum should be very clearly mentioned

Blank off flanges along with studs and bolts should be quoted as optional items

Any pumping accessory, gate valve (for the load lock), vacuum gauge, gauge controller, etc. should be quoted as an optional items

Any baking option (along with baking tape, temperature, controller, and measurement set-up) should be quoted as optional items



N.B. Two DN40CFF ports should be used as dummy, while each of the other two DN40CFF ports should be equipped with one BNC, one MHV, and one SHV vacuum compatible connectors

This drawing is ONLY a schematic layout of our complete set-up (not to the scale). This is to provide a quick idea to prepare a quote. However, in case of any confusion, you are encouraged to consult with the contact person at the time of preparing the quote (or even at the time of fabrication).

TERMS AND CONDITIONS:

Warranty: One year from the date of installation

Price: The price required to be quoted on Ex-works (inclusive of necessary export packing cost). This does not include the applicable duties & taxes. The price quoted in the tender required to be quoted in ink, both in figures & words. In case of any discrepancy, the rate quoted in figures will be accepted.

Price Validity: The price validity of the system should not be less than six months from the date of opening of the tender

Specification and quantity: The specification as well as the configuration and quantity of the equipment are required to be strictly as per the requirement of the indenter

Payment: The payment will be made against letter of credit (L/C). 90% of the L/C value will be released against successful delivery of the consignment at IOP site and balance 10% will be released after successful installation and commissioning of the system.

Delivery: The delivery of the system is required to be made within **12 weeks** from the date of establishment of L/C

Bank charges: The bank charges inside India to the applicant account and outside India to the beneficiary account

Installation: Installation of the system at our site (Institute of Physics, Bhubaneswar) with your instruments, accessories, tools & tackles; deploying appropriate manpower as required, at your cost

Service facility: Supplier should mention about the possible service set up in India and how capable they are to provide after sales service

List of Users: The supplier should provide a list of current users of their similar products in India

Liquidated damage: The liquidated damage is to be collected @ 0.5% of the total value per delayed week or part thereof or 5% (aggregate) of the total order value if such case arises

Testing: You are required to test all the technical specifications of the equipments. The testing equipments, manpower, along with the consumables as required for testing the system will have to be arranged by you at your cost

Supply of spares: Supply of spares should be ensured for at least for 10 years from the date of supply

Agent: An Indian agent, who will participate in this Tender on behalf of one manufacturer, will not be eligible to present another manufacturer.

DIRECTOR