Indian Institute of Science Bangalore

Prof. Mayank Shrivastava
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Inquiry Number: DESE/JK/MSA/019/2019-20
Dated: 26/12/2019

Request for Quote for the procurement of Atomic Force Microscopy (AFM) for semiconductor wafer testing

Indian Institute of Science, Bangalore
(Last Date: Jan 10th, 2020)

Dear Sir/Madam,

Kindly send your best price quotation for the following item with various accessories on C.I.P. Bangalore basis to the undersigned. Your quotation should clearly indicate the terms of delivery, delivery schedule, entry tax, payment terms, etc.

Your quote should also include mode of payment and **should reach the undersigned, duly signed on or before 1000 hours (IST) on Jan 10th, 2020.**

The quote must include all details of technical specifications of the equipment along with the commercial terms and conditions, the bill of materials, printed technical brochure and any other supporting document. **Please enclose a compliance certificate, printed on your letter head, along with the quote.**

The commercial bid must include the price of the item in Indian / Foreign currency, indicating the following separately:

a. FOB price
b. Freight and Insurance
c. Post warranty maintenance charges
e. Total

The quotation should address to:

The Chairman,
Department of Electronic Systems Engineering
Indian Institute of Science, Bangalore – 560 012

ATOMIC FORCE MICROSCOPE SPECIFICATIONS

1. ***Features:***
   - Decoupled XY-Z Scanner
   - Tip sample viewing top view optics
   - Full range of operation modes including but not limited to Contact Mode, Electric Force Microscopy (EFM), Force Curve Mode, Force Mapping Mode (Force Volume), Force Modulation, Frequency Modulation, Fluid imaging, Kelvin Probe Force Microscopy (KPFM), Lateral Force Mode (LFM), Magnetic Force Microscopy (MFM), Nanolithography/ Nanomanipulation, Phase Imaging, Piezoresponse Force Microscopy (PFM), Switching Spectroscopy PFM, Tapping Mode (AC Mode), Vector PFM, Loss Tangent Imaging, Dual AC, Dual AC Resonance Tracking, Scanning Tunnelling Microscopy, Conductive AFM and Scanning Thermal Microscopy
   - Conductive AFM / ultra-low current detection with noise < 0.1 pA
   - Integrated active Q Control

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2. ***Scanner:***
   - Decoupled movement of XY and Z - independently actuated using its own piezo stack and flexure stage.
   - Out-of-plane movement of XY scanner: less than 1 nm vertical movement over 50 µm of XY scan
   - High feedback speed by fast Z scanner (vendor should specify resonant frequency)
   - Performance Specifications: XY with closed-loop feedback control
     - Scan range: ≥ 100 × 100 µm (with a single scan head)
     - Noise: ≤ 0.6 nm RMS (closed-loop)
   - Performance Specifications: Z with closed-loop feedback control
     - Scan range: ≥ 15 µm
     - Noise: ≤ 0.1 nm RMS
     - Height / Floor noise: ~ 0.05 nm RMS
     - Height Detector Noise ~ 25 pm

3. ***Sample Dimension:***
   - The instrument must accommodate samples sizes of 100mm x 100mm (or bigger) and thickness of 10 mm or more (resolution: 0.1mm or better).
   - Vendor should specify maximum sample weight the scanner can handle without affecting the scanning capability.

4. ***XY-Z Stage:***
   - XY stage Manual / Motorized with 10 mm x 10 mm or more travel (Quote Manual and Motorized options separately: Option-1 as manual movement, Option-2 as motorized movement)
   - Manual / Motorized Z movement with 10 mm or more travel. (Quote Manual and Motorized options separately: Option-1 as manual movement, Option-2 as motorized movement)
   - Tip sample engage though software

5. ***Head:***
   - The instrument must use a low coherence light source (for example, a super luminescent diode, SLD or equivalent Laser source)
   - Cantilever deflection detection frequency 2 MHz or better
   - Suitable camera system for tip / sample viewing with digital zoom and camera resolution of 2 microns or better
   - Field of view 100 x 100 microns or better (Vendor should specify the exact field of view)

6. ***Controller***
   - The AFM control electronics must provide 100% digital operation.
   - The system must provide thermal tunes of the cantilever up to at least 2 MHz.
   - The instrument must allow digital Q-control in the range 2 kHz – 2 MHz.
   - The instrument must include software-controlled relays for the X, Y and Z high voltage supplies and the laser power.
   - ADCs – One 16-bit input operating at 5 MHz with seven gains (or better)
   - ADCs - Five 16-bit inputs operating at 100 kHz (or better)
   - DACs - Six ultra-low noise, fast 24-bit channels updated at 100 kHz (or better)
   - The instrument must include auto-configuration of external hardware and accessories.

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- Programable cantilever bias voltage control up-to ± 10 V (Vendor must quote, as option, higher bias voltage capability)
- Image size: 6000 x 6000-pixel density
- CE Compliant

7. Software

- Multiple data acquisition and display
- Adjusting feedback gain, set point, drive frequency/amplitude/phase in real time
- Active Q control
- Cantilever spring constant calibration
- Seamless data transfer to the analysis software
- Control and analysis must be user-programmable natively in an entirely open-source software programming language.
- The system's software must include a one-click configuration tool that sets up the software for standard and user-defined operation modes, such as imaging in air and liquid, contact mode, EFM, KPFM, PFM, force measurements, etc.
- Software must include a feature that automatically optimizes the imaging gain and setpoint for tapping mode operation.
- AFM control software environment must include 3D rendering technology for advanced image display. This feature must allow the user to generate, display and visualize 3 & 4D real-time scan images, as well as off-line processing.
- System must include a feature that automatically calibrates the cantilever sensitivity and spring constant by simply selecting the probe type and clicking a button.
- Seamless data software
- F-d spectroscopy control
- Running on Microsoft Windows (latest)

8. Imaging Modes

- Contact Mode
- True Non-Contact Mode
  - Tip-sample distance: 3 nm (or better)
  - Cantilever oscillation frequency: 1 ~ 600 kHz (or better)
  - Cantilever oscillation amplitude: 1~2 nm (or better)
- Electric Force Microscopy (EFM)
- Force Curve Mode
- Force Mapping Mode (Force Volume)
- Force Modulation
  - Adjustable modulation frequency: 1 kHz ~ 600 kHz
  - Amplitude detection: < 0.1 nm
- Frequency Modulation
- Fluid imaging
- Kelvin Probe Force Microscopy (KPFM)
- Lateral Force Mode (LFM)
- Magnetic Force Microscopy (MFM)

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- Nanolithography/ Nanomanipulation
- Phase Imaging
  - Phase resolution: ±0.01°
  - Phase from True Non-Contact, EFM, MFM, FMM, and SCM
- Piezo response Force Microscopy (PFM)
- Switching Spectroscopy PFM
- Tapping Mode (AC Mode)
- Tapping Mode with Q-control
- Vector PFM
- Loss Tangent Imaging
- Dual AC
- Dual AC Resonance Tracking
- Scanning Tunnelling Microscopy
- Conductive AFM
  - Current Noise < 3pA
  - Maximum Current Limit: 10 nA or better
  - Bandwidth: DC ~ 1.2 kHz
  - Gain: 10^6, 10^9 V/A
- Any other modes, which occur default modes with the quoted system should also be clearly mentioned.

9. Instrument Isolation

- The system must include a thermally- and acoustically-isolating enclosure.
- The system must include a vibration isolation table / platform suitable for the system

10. Optional Modes / Modules to be quoted separately (after all discounts, the price of optional items must be valid for 180 days)

- Scanning Thermal Microscopy
  - Spatial resolution: < 20 nm
  - Thermal spatial resolution: < 25 nm
  - Temperature sensitivity: 0.1 °C
- Upgrade to High Voltage PFM (with ± 200 V or higher)
- Upgrade to Scanning Capacitance Microscopy (if it's not part of standard system)
- Upgrade to Scanning Spread Resistance Microscopy (if it's not part of standard system)

Additional Items (Must be added to compliance certificate as well):

1. Support: Please provide details of support provided within the warrantee period. Technical support must be available in India, who is available as and when required during the warranty period.
2. Shipping: The cost of shipping up to IISc Bangalore should be included in the quote. IISc Bangalore will help with customs clearance at Bangalore Airport.
3. Installation: Please list a set of acceptance tests for on-site (vendor) inspection and after installation at IISc Bangalore. Complete demonstration and training during installation is a MUST
4. Spares: List out the spares (tips for various modes) provided with the system and numbers.

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5. Other Options: Spares (tips for various modes) required to operate must be quoted (with best possible discount) separately.
6. Training and Installation: Must be without charge. Training must be available as and when required during the warranty period.
7. Warranty: Min one year (from the date of installation). Preferred, 2 years or as high as possible.

All of the above mentioned technical specifications are highly desired. However, lower technical specifications may be considered if the above mentioned specifications are found to be unsuitable in financial terms. The Institute reserves the right to go for lower specifications taking into consideration its technical preferences and financial constraints. Vendors are encouraged to highlight the advantages of their tools over comparable tools from the competitors.

Terms and conditions (should be included in compliance certificate):

1. Necessary training to operate the procured setup and required literature support should be provided without additional cost.
2. In principle onsite installation should be free of cost. The amount of time / day committed by the engineer during installation must be clearly stated.
3. Software upgrade, if any, must be free of cost for next 5 years.
4. The vendor must assure that there are no bugs and glitches with the integration. In case of glitches or bugs at the time of installation, vendor must fix the issues in less than three days from the start date.
5. In case of hardware/software issues or support, vendor should be able to provide required solution within three days.
6. All equipment must be well calibrated before and after installation.
7. Additional quote for an annual maintenance contract should be included for the next 5 years.
8. The vendor should have a good track record of delivering such equipment to universities/research institutions in India and high rank institutions worldwide (please furnish the details).
9. Please provide list of customers, in India, who have procured your equipment in last 5 years.
10. The vendor should be able to repair and maintain the equipment, once it is installed in India. No travel claims must be made by vendor for servicing during the warrantee/guarantee period.
11. The lead time for the delivery of the equipment should not be more than 2 months from the date of receipt of our letter of intent. The smallest lead time will be appreciated. Our expectation is shipment immediately after PO and full or part payment post installation.
12. On all systems the payment terms will be specified in the commercial proposal and is subject to negotiation.
13. The validity period of the quotation should be 180 days at least.
14. Please provide details of the number of trained personnel in India, who can service the machine.
15. System/computer required to operate the tool must come with the system with all software pre-loaded.
16. Free copies of analysis software must be provided with the tool (list out numbers)

Sincerely,

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Secretary (Ms. Supria's) Contact: 9972092771
(On Behalf of Purchase Committee)