

Specifications for Atomic Force Microscope (AFM)

The Machine

- The atomic force microscope (AFM) is intended for the characterization of macro/micro/nano materials
- The AFM should be the state of the art machine with the capability of analyzing conducting and non-conducting nanomaterials with following specifications

A. Detailed Specifications of the Machine (AFM)

A.1. Main Features

- **Imaging/Operating Modes:** Contact, Non-contact, Tapping, Phase Contrast, Lateral Force, Magnetic Force, Force Modulation, Scanning Tunneling
- **Non-Imaging Modes:** Force/Distance spectroscopy, Nanolithography, Nanomanipulation and Current/ Voltage (I-V) spectroscopy.
- Library of standard and user defined operation/imaging modes
- **Scanning System:** Closed loop operation with position sensors, **separate XY and Z scanner** to eliminate “bowing” effect in images
- **Scan Range:** X&Y axes > 90 μm , Z axes > 10 μm in closed loop. The same scanner should also be capable of scanning smaller areas of $\sim 1 \text{ sq-}\mu\text{m}$.
- **Scan Resolution:** < 2 nm in closed loop and < 0.2 nm in open loop or better in both cases
- **Color Video Microscope:** High resolution/ magnification color video microscope with light source for sample and AFM tip/probe observation
- **Controller and Electronics:** Digital precision controllers for interfacing between the computer, the scanning system, and the probe/tip motion sensor
- **Calibration:** AFM calibration kit with necessary samples (HOPG, Mica..) and tools
- **Vibration Noise/Isolation:** Vibration isolation stage/table, Acoustic enclosure
- **AFM Tips/Probes:** AFM tips/probes for the above mentioned imaging/operating modes. The number of tips/probes that will be supplied to be specified.
- Details of tips/probes resolution, and material to be provided
- All compatible cables and connectors
- **Sample size:** 20 x 20 x 5 mm or higher
- **Nano Indentation Kit** with all the required accessories, Load: 20mN or higher, displacement resolution 0.3 nm or better

B. Computer and Software

- **Computer:** Compatible latest high performance computer with Windows operating system (excluding Windows Vista) and two monitors, minimum 8 GB RAM, CD/DVD writer, minimum 500 GB hard disk. The computer should be guaranteed for a period of 2 years from the date of AFM commissioning. It is preferred that the computer is procured in India, integrated with the equipment and the required software's are to be installed.
- In-addition to the desktop a compatible laptop with latest specifications and suitable software for AFM image analysis and data processing to be provided with details
- Compatible color laser printer & scanner to be provided with details
- All catalogues related to Software / Hardware to be provided

- **Software:** Software to operate the AFM, analyze the data i.e. AFM image analysis including section, histogram, roughness, particle analysis, and masking should be provided
- Software should perform all control functions and should be capable of post processing, analysis, storage and play back of 3D/2D images as per the relevant standards
- **Reinstallation CD's:** CDs containing all the reinstallation software and manuals should be provided
- Software upgrades as and when made available and any price involved should be quoted

C. Power Requirements

- Power 220-240 V AC, 50 Hz
- Suitable UPS(APC/ SOCOME) with backup power of upto 30 minutes to be quoted

D. Qualification Criteria & Other Aspects

- The vendor should have supplied minimum two AFM machines in India and details should be furnished. A certificate from the users should be furnished for, the satisfactory operation of the instrument
- Should have agents in India to provide after sales service, support and maintenance
- The machine should be guaranteed for a period of 2 years from the date of commissioning. During warranty period, if there is any repair to be carried out at the suppliers works, transportation cost of equipment/component besides repair / replacement charges, if any, should be borne by the supplier.
- AMC charges for 3 years beyond the warranty period of 2 years should be quoted
- Photographs and catalogues related to every item of AFM should be enclosed
- **AFM Training:** All the expenses related to training in following circumstances to be specified
 - By OEM engineers at BHEL R & D
 - For two BHEL engineers at supplier's works (For BHEL engineers travel expenses including boarding and lodging will be borne by BHEL)
- **AFM inspection:** If AFM training is provided to BHEL engineers at supplier's works, pre-dispatch inspection of equipment will be carried out at supplier's works
- If training is provided by supplier's engineers/technicians at BHEL R & D complex, the AFM will be inspected at BHEL R&D and if the equipment or any part of it is found defective necessary replacement/ repair shall be carried out by the supplier and all the related formalities and expenses including transport should be borne by the supplier
- **Periodic AFM training:** It is preferable that the supplier should provide periodic training in India/Hyderabad at periodic intervals of 6 months
- Dimensions of equipment, weight and space requirements should be submitted in technical offer.
- Installation & Commissioning should be carried out at BHEL R&D. Pre-installation requirements should be furnished
- Commissioning charges, if any, to be indicated
- Compliance statement of specification to be submitted along with the offer. Failure to give compliance statement, the offer is liable to be rejected. All tender specifications to be compared with machine offered line by line and documentary evidence must be enclosed by the supplier along with quotation
- Two hard copies of all the operational manuals related to the AFM system have to be provided
- Supplier must be ISO 9001: 2001 certified

E. Option

- **Electrochemical/ Electro Chemistry** measurement kit all the required accessories
- Other system (AFM) compatible material **tips/probes** available to be quoted
- The supplier should certify the availability of spares for a minimum period of 10 years from the date of AFM commissioning

F. Spares

- Minimum spares (cantilever tips: 10 , scan heads: 1) required for trouble free operation should be quoted

G. Technical & Commercial bid submission

- G.1.** Technical offer with all catalogues should be provided
- G.2.** Compliance statement meeting the specification line by line should be provided (Failure to give compliance statement, the offer is liable to be rejected)
- G.3.** Commercial bid with terms and conditions to be submitted in a separate Sealed Cover

H. After the AFM delivery to BHEL R & D, if the AFM equipment is installed in existing R & D building and later if it has to be shifted to the new building (Center for Nanotechnology and Applications) this has to be done by the supplier and related expenses should be specified. The shifting will be within 9 months of initial installation

I. Delivery: The equipment should be delivered within 3-4 months from the date of placement of purchase order

Note: All covers should be clearly marked indicating the contents and should be SEALED.

For any Technical Clarification, please contact :

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