

**NANOSCALE RESEARCH FACILITY (NRF)
INDIAN INSTITUTE OF TECHNOLOGY DELHI
HAUZ KHAS, NEW DELHI- 110016**

Date: May 12, 2011

NOTICE INVITING QUOTATIONS

Ref: No. NRF/AFM/2011

Due date: June 3, 2011

Please send your quotations to the undersigned in a sealed cover super scribed with our Ref no. & due date for the following items (atomic force microscopy with multiple options).

S.No.	Name of item with full specifications	quantity
1	<p>Scanning Probe Microscopy system</p> <p>A. Operating modes:</p> <ul style="list-style-type: none"> i. Tip/sample scanning configuration ii. Contact, Non-contact, AC (intermittent contact), Constant force, Constant height, phase, amplitude and force modulation imaging, Lateral Force iii. Scanning tunnelling microscopy (STM), scanning magnetic force microscopy(MFM), Electric Force microscopy (EFM), Surface potential (Scanning Kelvin Probe Microscopy), Piezo Force Microscopy (PFM), Conductive AFM imaging, scanning thermal microscopy (SThM) and all other standard imaging options. <p>B. Other non-imaging modes: Current-voltage (I/V) spectroscopy, Force-distance spectroscopy, nanoindentation, nanolithography and Nanomanipulation.</p> <p>c. Specimen Stage:</p> <ul style="list-style-type: none"> i. Motorized sample translation stage with about 125 mm travel in the X and Y directions ii. Step resolution ~2μm and at least 8μm repeatability for any directions. iii. Z translation stage: > 25 mm motorized and at least 5 mm on servo control iv. The sample stage should able to rotate about its centroid v. Sample holders of ~150 mm diameter with vacuum 	1

chuck to hold semiconductor wafers, hard drive etc. Magnetic holders for smaller samples up to ~15 mm. Sample holder should be compatible with ~10 mm thick samples.

- vi. Compatible with sample weight: up to 500 gm.

D. Scanners:

- i. XY scan range: 90 μm \times 90 μm (closed loop)
- ii. Z range: 10 μm , large vertical range ~30 μm should also be quoted, Z noise: < 0.05 nm and sensor non-linearity < 0.05%
- iii. Imaging bandwidth >600 Hz
- iv. For small scans XY scanner: 10 μm \times 10 μm (closed loop), Z range: 2 μm , Z noise: < 0.03 nm and sensor non-linearity < 0.05%, XY non-linearity < 1% (in case of single scanner the scanner used must be compatible with these specifications for small scan size)
- v. Standard scan modes in air and fluid should be available
- vi. All three axes should have closed feedback and independent nano positioning sensors
- vii. Overall drift of the system should be < 0.2 nm/min
- viii. Scan heads must be calibrated with NIST standard.
- ix. **The AFM must be capable of scanning atomic resolution images on atomic lattice structures such as Mica.** The AFM should be capable of scanning <300 nm scans in closed loop operation and maintain positional accuracy of <0.15 nm.

E. Microscope optics:

- i. Sample illumination: Integrated color camera (minimum 5 MP) with software controlled power adjustable white LED light source
- ii. Motorized zoom and focus
- iii. Field of view variable from min 1 mm to 200 μm
- iv. Optical resolution: better than 2 μm
- v. Camera software should be within AFM software.

F. Electronics and controller:

- i. High performance DSP based electronics
- ii. Data acquisition sampling rate ~50 MHz
- iii. All the ADC and DAC must be \geq 16 bits
- iv. Digital Q control of the cantilevers quality factor, should

allow simultaneous collection of up to 8 data channels simultaneously, should provides thermal tuning of cantilevers to 2MHz in air or fluid to determine cantilever's resonant frequency and spring constant (**demonstrable**)

- v. Should provides 3 user accessible lock-in amplifiers and should be capable of applying up to 10V bias to the AFM tip or sample
- vi. It must provides real time adjustment to all scanning parameters – scan rate, scan size, scan offset, gains and others
- vii. Should support use of micro-actuated cantilevers for fast scanning (up to 10Hz)
- viii. Fast, single cable USB based computer-to-controller communication should be available, electrical noise: < 1 pA, Bandwidth: ~500 kHz
- ix. Access to all major signals on BNC connectors through either controller front panel or by a break-out box
- x. Image resolution must be greater than 5k × 5k.

G. Software and computer:

- i. Fully functional software for data acquisition and data analysis for operating system Windows XP or Vista
- ii. Thumbnail view should be available to allow searching, sorting and viewing AFM-specific data files to work with other software
- iii. Scientific publication-quality graphing and layout capabilities and movie making facilities should be available within the control and analysis software environment
- iv. Generation, display, and visualization of 3D images in real-time (during scan as well as off-line processing).
- v. **Computer:** Windows XP or vista with dual flat panel Monitors (21 inch or larger), 320 GB HDD, CD/ DVD writer, USB ports (8), should be able to export files to the clipboard or save as JPEG, PNG, BMP, TIFF etc.

H. Vibration isolation:

- i. A compatible active/passive vibration isolation system for atomic scale imaging.
- ii. The system should include acoustic enclosure which should provide acoustic noise isolation better than 20 dB.

I. Sample heating/cooling option: The sample heating/cooling option (-25 °C to 250 °C) with 0.1 °C temperature stabilization.

	J. Power: 220-250 Vac 50 Hz	
2	<p>Other desirable operating mode:</p> <p>a) Liquid cell imaging:</p> <p>i) Disposable/easily cleanable small volume fluid/gas cell</p> <p>ii) A sealed environmental chamber with multiple ports for fluid/gas exchange.</p> <p>b) Nanoindentation and nanomechanical measurements:</p> <p>i) Both cantilever based nanoindentation and full-fledged nanoindentation capabilities using standard indenters like Berkovitch, Cube corner and spherical etc. should be quoted</p> <p>ii) No drift problem</p> <p>iii) Diamond coated tip based Nano Indentation with necessary hardware and software should be provided.</p> <p>c) Nanolithography and nanomanipulation:</p> <p>i) The cantilever should be able to control lithography and manipulation applications. Capabilities should be preferably built-in without the need for extra hardware or software</p> <p>ii) Should able to generate patterns with freehand curves and possibility of patterns import should be present</p> <p>iii) The cantilever amplitude, deflection, and voltage must be controllable and modulated during lithography.</p> <p>d) Conducting AFM for highly resistive materials:</p> <p>i) Apart from the normal conducting mode capability, it should be able to measure current for highly resistive samples with a resolution of approximately 50 femto-amps, having maximum noise level of 100 femto-amps.</p>	

Calibration samples for all the different operating modes as given in S. No. 1 above must be provided. A set of spring constant calibrated cantilevers for force-distance microscopy and tip radius calibration gratings should also be provided. **The atomic scale imaging of mica in ambient condition should be demonstrable.** All the necessary installation and training must be provided by the vendor.

Users list: Vendors should also specify the user list for the said item in India as well as abroad.

Warranty: (Required) On-site comprehensive including part replacement specify for 1 year and 2 years. This should be clearly shown in the technical as well as financial bid.

Terms and conditions covering submission of quotations

1. **DELIVERY:** The rate must be C.I.F. IIT Delhi (Air Freight),
Delhi Airport
2. **TERMS OF PAYMENT:** Letter of credit
3. **VALIDITY OF QUOTATIONS:** **three months or more**
4. **CORRESPONDENCE:** No correspondence regarding acceptance
/rejection of quotation will be entertained.
5. **SUBMISSION OF QUOTATIONS:** Separate quotations should be submitted
for technical bid and commercial bid in two
separate and clearly marked envelopes.
6. **DISCOUNTS/REBATES:** Special discounts/rebate wherever admissible
keeping in the view that supplies are being made
for an Educational institute may be indicated in the
offer.
7. **DIRECTOR'S RIGHT:** Director, IIT Delhi reserves the right of acceptance
or rejection of any or all quotations without
assigning any reason.

Please specify terms and conditions. The quotations must have a validity of 3 months. Sealed quotations (separate technical and financial) may be send to the following address.

Dr.J.P. Singh

Associate Professor

Block VI, Room no. 121 (NRF)

Indian Institute of Technology Delhi

Hauz Khas, New Delhi 110016

INDIA

E-mail: jpsingh@physics.iitd.ac.in