

**Office of the Central Purchase unit  
National Institute of Technology Srinagar.**  
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**E-TENDER NOTICE (CORRIGENDUM)**

**Tender document No.**

**NITS/CPU/ET/2019/CRFC/005 dated 23.11.2019 for  
supply of Atomic Force Microscope (AFM) for Central Research  
Facility Centre.**

<b>S.No</b>	<b>Description of item</b>	<b>Bid security</b>	<b>Last date &amp; time for purchase of bid document online</b>	<b>Last date &amp; time for online submission of bids</b>	<b>Date &amp; time for opening of Technical bids</b>
<b>1</b>	<b>Supply of Lab equipment for CRFC (Atomic Force Microscope) (AFM).)</b>	<b>2,26,000/=</b>	<b>03.01.2020 16.00 hrs</b>	<b>06.01.2020 13.00 hrs</b>	<b>06.01.2020 at 15.00 hrs.</b>

**As per discussions held during pre-bid conference, the revised specifications of mentioned equipment is attached.**

  
Officer In-charge  
Central Purchase Unit

No. NITS/CPU/19/5345  
Dated 27.12.2019

Description of Item	Specifications
<p><b>Atomic Force Microscope (AFM)</b></p>	<p><b><u>Detailed Technical Specifications</u></b></p> <p>AFM system should consist of the following various modes of detection and measurements, in addition to basic Atomic Force Microscopy (AFM) for characterization of the surface of soft and hard thin films, Polymer samples, Nano materials, Tribology samples, Biological samples, Liquid samples, Dispersion samples, Magnetic samples, Semiconductor samples, Piezoelectric samples, Ferroelectric samples, Microelectronics samples, etc. System should have a capability to use in central Research Facility with easy to use and sufficient modes which can cover multiple research area.</p> <p>Sample Scanning/Tip Scanning or such combination would be acceptable.</p> <p><b>1. Cantilever</b></p> <p>1.1. Cantilever Alignment: Manual/Automatic Laser Positioning (Automatic laser positioning is preferable).</p> <p>1.2. Surface Engagement: The tip sample engagement must be controlled by software automatically.</p> <p>1.3. Cantilever Exchange: A Tool (Special tool is preferable) to Load and unload cantilevers on to the Z-Scanner should be offered. The Tool should accommodate all types of commercial cantilevers and must be user friendly.</p> <p>1.4. Cantilever Types: Suitable Cantilevers should be offered for all the modes quoted with minimum 20 nos each. (Detailed technical specifications of all the tips/probes are to be provided)</p> <p style="padding-left: 40px;"><b>Required Probes for different modes;</b></p> <ul style="list-style-type: none"> <li>❖ Contact Mode Probes</li> <li>❖ Tapping Mode/Non-contact Mode Probes</li> <li>❖ Pulsed Force Mode Probes</li> <li>❖ Electrical and Magnetic Imaging</li> <li>❖ Scanning Tunneling Microscope</li> <li>❖ Liquid and Biological Imaging: Tips optimized for liquid imaging and bio-material characterization.</li> </ul> <p>1.5. Compatibility: Should be Compatible with a wide range of commercial available cantilevers with typical specs as below</p>

- a. Resonance frequency: 60 kHz to 1.3 MHz
- b. Length: 20  $\mu\text{m}$  to 500  $\mu\text{m}$
- c. Width: 10  $\mu\text{m}$  to 50  $\mu\text{m}$
- d. Thickness: 0.8  $\mu\text{m}$  to 10  $\mu\text{m}$
- e. Chip size 3.4 x 1.6 x 0.3 (L x W x T, mm)

1.6. System must include a single probe holder that supports all listed mode of operation and supports operation in both air and liquid for those modes where liquid operation is possible.

1.7. The cantilever holder and the optical lever assembly (laser, optics and detector) must be housed within a single rigid frame. This eliminates artifacts due to relative motion between the optical lever arm and the cantilever during imaging and force measurements.

## **2. Scanner Specifications:**

2.1. X-Y scan range: 90  $\mu\text{m}$   $\times$  90 $\mu\text{m}$  or more.

2.2. Z scan range: 10  $\mu\text{m}$  or more.

2.3. X-Y position noise: X-Y position noise:  $\leq 0.6$  nm RMS or less (closed-loop),  $\leq 0.1$  nm RMS or less (open-loop).

2.4. Z noise:  $<0.06$ nm RMS or less.

2.5. The quoted scanner must cover all applications on single scanner, eliminating the need for multiple scanners. However, systems which need multiple scanners for large area scanning and separate for high resolution small area scanning the system offered must include such multiple scanners.

2.6. Manual/motorized stage (XY) (Programmable motorized stage is preferable) for multi-site measurements integrated stage control for fast navigation.

2.7. The scanner must be sensed and be able to operate in open and closed-loop in XY and Z.

## **3. Sample size:**

3.1. Max sample diameter: 80 mm or more.

3.2. Sample thickness: 10mm or more.

#### 4. Motorized stage:

4.1. Must come with a 4 inch large or more manual/motorized XY Stage (Motorized stage is preferable) with automated tip approach, focus and stage control. Stage XY translation should be 90mm×90mm. XY Stage position accuracy/ repeatability 2 micron (or better)

4.2. Z Stage > 10mm or more travel.

4.3. The AFM must have manual/motorized (Motorized stage is preferable) XY and Z positioning stage.

4.4. Manual joystick control for moving stage in XY position and optical lever assembly.

#### 5. Modes of operation:

The system must include the following scanning modes:

5.1. **AFM Contact Mode:** Include minimum 20 probes. 4 Cantilever Layout. Silicon Nitride tips for long life in contact mode. Spring constant to be in the range of 0.06 N/m for the softest cantilever in the layout and <0.4 N/m for the hardest cantilever.

5.2. AFM Non-Contact Mode - include at least 30 probes

5.3. Tapping Mode/Intermittent Contact Mode: include at least 10 probes

5.4. A **Pulsed Force Mode/Quantitative Nano Mechanical Maps:** Include minimum 20 probes.

where the AFM tip is modulated by sinusoidal wave at a user selectable frequency up to 2KHz with following benefits and to operate in Air and Liquid.

**A.** High Resolution Imaging than any other imaging mode.

**B.** Sample Tip interaction forces are as low as <50pN which is much lower than Tapping Mode interaction forces.

**C.** Such low interaction forces protect delicate samples and tip & also limits the compression of soft samples. Real time force interaction is preferred

**D.** Latest advanced imaging mode (AFM) for Automatic image optimization for faster, more consistent results, regardless of user skill level.

5.5 System must include a general purpose imaging mode with all of the following features:

- a) Automatic optimization of critical imaging parameters including set-point, gain, scan rate and Z limit
- b) Mode must operate in both air and liquids
- c) The cantilever resonance be “tuned automatically
- d) The pixel resolution of at least 512 x 512 pixels to capture such data should be rendered within reasonable scan rates <10 minutes per scan or better.
- e) Directly controls the tip-sample imaging force down to at least 50 pN or better
- f) Mode automatically compensates for drift of the deflection signal

5.6. **Lateral Force Microscopy**

5.7. **Phase Imaging**

5.8. **Force Modulation Microscopy.** Must include 10 probes.

5.9. **Force-Distance (F-D) Spectroscopy:** with mechanical properties like Adhesion, elasticity, Youngs modulus to be offered.

5.10. **Magnetic force microscopy MFM.** Must include 10 probes. Cobalt-Chromium coated (front and back) tips for MFM. Probe has a nominal tip radius (35 nm radius is preferable) for excellent lateral resolution for MFM and cantilever with conductive coating for electrical and capacitance application.

5.11. Electric Force Microscopy EFM. Must include 10 probes.

Platinum-Iridium coated (front and back), electrically conductive tip for Electrical Force Microscopy (EFM), Kelvin Probe Force Microscopy (KPFM), and PFM.

5.12. The MFM/ EFM and topography images should get displayed simultaneously in real-time as acquired line-by-line.

5.13. Must include basic nanolithography capability

5.14. Nano indentation: Include diamond tip for nanoindenting/ Nanoscratching applications.

5.15. **Piezo-response microscopy (PFM)** must offer a frequency range from 1 kHz to 1 MHz. Must include 10 probes.

5.16. **Surface Potential Microscopy (SPoM/ SKPM)** must be offered in two complementary implementations: A dual-frequency, dual-pass technique as well as a single-frequency, two-pass technique.

5.17. Liquid imaging with suitable fluid cells minimum 10 suitable probes. Tips optimized for liquid imaging and bio-material characterization.

**Optional:**

**Cantilever exchange:** A Tool (Special tool is preferable) to load and unload cantilevers on to the Z-Scanner is desired. The Tool should accommodate most of the compatible commercially available cantilevers and must be user friendly.

**6. System Optics:**

6.1. AFM scanning cantilever/probe optical surface should be viewable on axis in real time via Direct Optical Video Access with resolution of 3 $\mu$ m or better.

6.2. The Field-Of-View (FOV) must be software controlled zoom and cover the range from 720 $\mu$ m down to 240 $\mu$ m or better.

6.3. The AFM must include top-view optics with **Manual**/motorized (Motorized is preferable) focus & digital zoom

6.4. The optics must have software-controlled white LED or Kohler illumination.

6.5. The optics must include High resolution camera (3 $\mu$ m), and software to display and store the optical image from within the AFM software.

It must have at least two, software selectable magnifications.

Overview of the entire sample carrier

Highlight of the region of interest (ROI)

Quick navigation to ROI

Highlight of the current measurement position. Side view camera enables live tracking of the exact cantilever position

Automatic engagement procedure via software

Ready for scanning within seconds.

**7. System Controller:**

7.1 The system must provide the capability to calibrate the cantilever spring constant by thermal tuning of the cantilever.

7.2 Must have 20-bit or more digital-to-analog converters for scan control in X, Y and Z.

7.3 It must be provide fully software-controlled, digital Q-control of the cantilevers.

7.4 Must have generalized multi-channel spectroscopy capability

7.5 It must allow customizable input/output signal paths through a signal access module integrated inside the controller with BNC connector whose function is software-selectable.

7.6 Must provide 2 or more users accessible lock-in amplifiers

7.7 It must provide real time adjustment to all scanning parameters scan rate, scan size, scan offset, gains and others

#### **8. Light source /Detector:**

Appropriate laser light source, Four Quadrant (or better) position sensitive photo detector

#### **9. Data acquisition and image processing software**

- ❖ The data acquisition system must be capable of recording individual image sizes of 8000x8000 pixels<sup>2</sup> or greater.
- ❖ The AFM system should have software for multiple data acquisition and display.
- ❖ Able to perform multi-tasking with Microsoft windows based data acquisition or equivalent, optical view and for imaging processing, analysis and presentation for all modes in SPM/ AFM should be provided
- ❖ Should facilitate seamless data transfer to the analysis software
- ❖ Software package must include both image acquisition and data processing software.
- ❖ Software must be able to be installed on unlimited number of off-line PC.

#### **10. Computer with Monitor**

The system must have SPM /AFM compatible latest version high performance computer, 30” or higher monitor, sufficient number of USB port, DVD RW, Mouse, Keyboard, etc. Appropriate cables and power cables to be provided

#### **11. Power supply and back up**

The instrument and computer should be compatible with the power supply specification in India, 220V, 50/60 Hz, (Operating range 210-240V). An online UPS must be provided for AFM system with minimum 1 hour of power backup.

**12. Installation and training**

The system must be installed, and demonstrated by factory trained service engineers at our site free of charge; Comprehensive on-site training required to our satisfaction

**13. Required Documents along with technical specifications**

- a. It is important to note that the bidder should enclose AFM images of different types of samples such as polymers, semiconductor, thin films, metals etc. Obtained in different modes as applicable. Also, please specify the pixel dimensions, mode of operation for each of the images. This is required for an objective evaluation of the technical bid. All these results should be generated from a system which is similar to the one that is being offered to NIT Srinagar.
- b. List of at least 3 users in India, with similar systems installed preferably in last 5 years.
- c. The name(s) of the service engineer(s) employed by them who is/are competent to service the equipment being quoted with their locations in India.  
  
It is preferable to have an OEM application support center in India for faster support.
- d. Detailed user instruction manual, operation/instruction manual, troubleshooting manual, CDROM tutorials for AFM.

**Note: - Equipment should be supplied with warranty and AMC executed**