

# SCANNING TUNNELING MICROSCOPE



## Features:

- Automatic mechanism to approach sample
- Automatic sample and camera moving by software
- Capability of spectroscopy to verify the material type with I-Z and I-V modes at desired point of surface of sample
- Engraving of nanometer-scale surface by lithography (manually or by importing the pattern images from the desired file)
- Ability of tilting (adjusting X, Y axis in sample)
- Capability to change size, angle and location of image by software without handling the sample and ability of automatic offset calculation
- Ability to analyze the image independently from the scanning
- Ability to apply custom filters in three stages on the data and possibility of retrieving the data
- Capability to take the repeated imaging without user intervention and possibility of changing conditions of imaging automatically
- Ability to export result, which is compatible with other softwares (txt. file)
- Ability to storage all data of scanning with image or spectroscopy curves.
- Advanced mechanical design with very low thermal drift and the ability to view online height and current during scanning
- Imaging capability in both constant height and constant current modes with minimum electronic noise.
- Ability to change the parameters of the PID, Current and voltage during imaging
- Provide 2D and 3D images at nanometer-scale - simultaneously (such as biological molecules, DNA, Antibody and nanomaterial)
- Ability to display multiple clear and accurate 2D and 3D image files in order to compare them (for study on changing the status of polymers over the time)
- Ability to measure the size of material on the image
- Hardware zoom capability for desired more detailed image.
- Software zoom capability for desired area
- Ability to customize the color of image file Specification

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A scanning tunneling microscope is a powerful tool for obtaining micrographs from conductive and semiconductive materials. The imaging technique has recently been improved for microscopy of nanostructured biomaterials on highly ordered atomic surfaces. We describe, here, high resolution imaging of individual IgM and IgG using a scanning tunneling microscope (Naima-STM) in air condition. The biomolecules were immobilized on the surface of Highly Ordered Pyrolytic Graphite (HOPG). Obtained micrographs could reveal structural details of immunoglobulins G and M on the atomically flat surfaces. Obtained results confirmed that STM could be more useful than other microscopy techniques for the analysis of single biomolecules.

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## Advantages

- Expandable to suite user needs
- Designed for quick and reliable measurements by experts and novices alike
- Unique price/performance ratio for research and teaching
- Mechanical stability
- Thermal drift balance
- Low electronic noise
- Ergonomic design
- Windows-based powerful software
- Easy maintenance



### STM Software

Various charts of the scan data online	2D view image, line graph, spectroscopy (I-V, I-Z)
Various charts of the image data offline	2D view, 3D view, line profile, color map
Various charts of the spectroscopy (I-V, I-Z) data offline	Line graph, first and second derivative, ...
Noise reduction and feature enhancement	Data filtering in three levels
Lithography pattern	16 Color BMP and .dxf files
View all maximum scan range and change parameter very user friendly	
Data export	TXT, BMP, JPEG, GIF, ...
Automatic image transfer to offline processing software NAMA Analyzer	

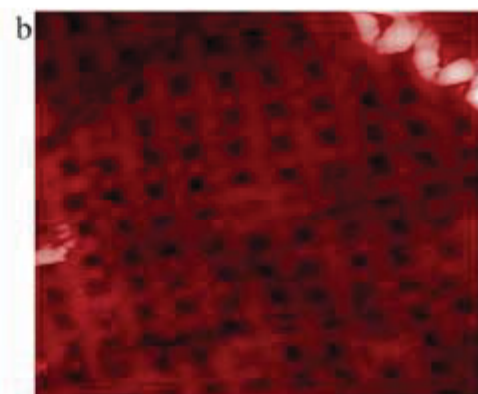
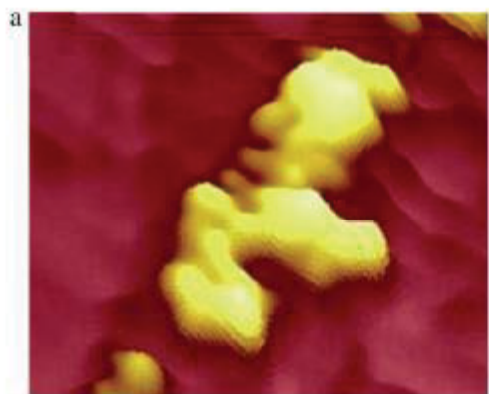
### Electronics

Electronics size	55*55*18 cm
Power supply	220 V~/ 50 Hz/ 1A
Computer Interface	16 bit Data Acquisition Hardware
Scan speed	Up to 100 Line/s at 128 data point / line
Scan image rotation	0 - 360°
Sample tilt	Automatically by software
Spectroscopy modes	Single point measurement
Spectroscopy data point	Up to 2000

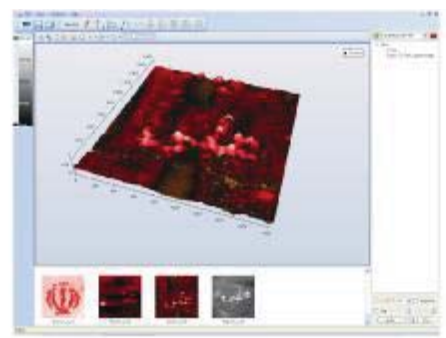
### STM Measurement

Maximum scan range	8-16 $\mu\text{m}$ ( $\pm 4000$ nm)
Maximum Z-range	3 $\mu\text{m}$ ( $\pm 1500$ nm)
Derive resolution Z	0.045 nm
Derive resolution XY	0.12 nm
Current set point	0.02 - 100 nA in 3 pA steps
Imaging modes	Constant current (Topography), constant height (Current)
Spectroscopy modes	Current-voltage, current-distance
Lithography modes	Bitmap, vector and manual
Tip voltage	$\pm 10$ V in 0.3 mV steps
Sample approach	Fully automatic and manually
Sample size	Max 20 mm diameter

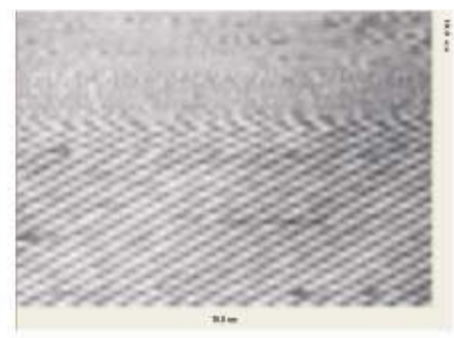
# ” Results



(a) 3D image of a single antibody (IgG) molecule, which shows orientation of this molecule imaged by NAMA-STM, (b) Polymer surface image using NAMA-STM at high resolution.



Lithography by NAMA - STM  
800x1000x35 nm



Atomic resolution of HOPG  
by NAMA - STM 10x10x0.15 nm