

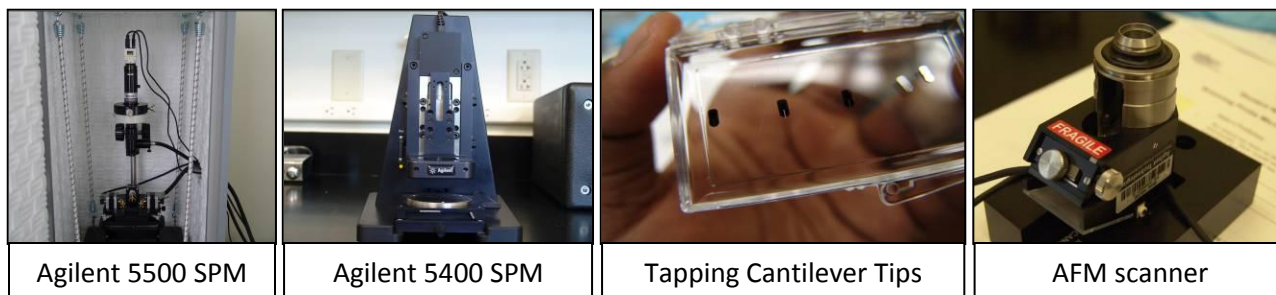
## AGILENT 5500 AND 5400 SCANNING PROBE MICROSCOPES (SPM)

### NBCF 211

Nanosciences and Biotechnology Core Facility (NBCF) at Tennessee State University houses Agilent Technology's 5500 and 5400 state-of-the-art scanning probe microscopes (SPM). These microscopes are modular in function and can accommodate both atomic force microscope (AFM) and a scanning tunneling microscope (STM) with various modes.

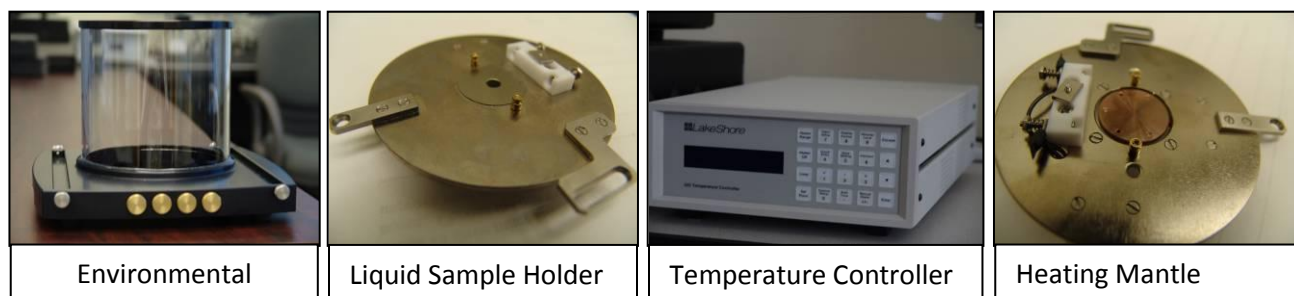
#### *Atomic Force Microscopy*

The atomic force microscope characterizes samples with probes that can image, measure, and manipulate matter in both micro- and nano-scale. Examples of different imaging modes are: magnetic, conductive, contact, tapping, non-contact, force spectroscopy, etc., each with corresponding ultrasharp cantilever tips. Each mode provides specialized readings (amplitude, phase, deflection, etc); however, all provide 3D topographical micrographs. The NBCF has two interchangeable scanners of range 9x9  $\mu\text{m}$  and 90x90  $\mu\text{m}$ .



Nanolithography is the art and science of etching, writing, or printing at the nanoscopic level, where the dimensions of characters are on the order of nanometers (units of  $10^{-9}$  meter, or millionths of a millimeter). This includes various methods of modifying semiconductor chips at the atomic level for the purpose of fabricating integrated circuits. The SPM allows surface viewing in fine detail without necessarily modifying it. The AFM can be used to etch, write, or print on a surface in nearly single-atom dimensions.

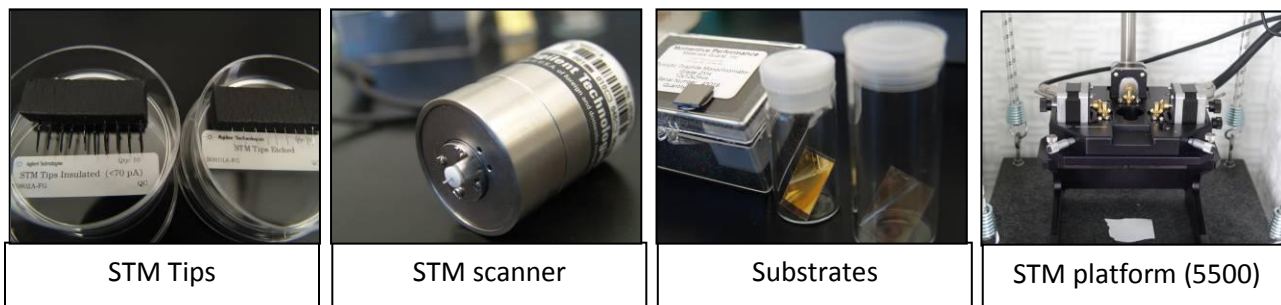
Agilent's environmental isolation chamber (EIC) is unique in the industry. Specifically developed to meet the many requirements of intricate, demanding atomic force microscopy, it offers researchers an extraordinarily reliable tool for imaging in a controlled environment. Agilent's EIC is particularly useful for experiments involving polymers, films, and electrochemistry. The EIC mounts directly to the Agilent 5500 AFM microscope and provides a hermetically sealed sample compartment that is completely isolated from the rest of the system. Eight inlet/outlet ports permit the flow of many different gases into or out of the sample area. The EIC is compatible with Agilent's temperature controller and patented MAC Mode®, as well as with an array of other powerful options from Agilent. Agilent's scanners reside outside the EIC, so they are protected from contamination, harsh gases, solvents, caustic liquids, and other damaging experimental conditions. With the EIC, humidity, oxygen, and reactive gas levels can be controlled. Commonly used in conjunction with the environmental chamber, the liquid sample holder can be used to preserve cells in a liquid solution as well as nanolithography techniques that require liquid solutions. Other uses include chemical reactions such as polymerization.



The AFM systems also have a heating mantle specified at a temperature range of 30°C to 50°C. A special sample holder with a copper base works in conjunction with a temperature control box. Although the gentle heating system is primarily used for environmental temperature control for cells, it can also be used for mild chemical reactions.

### ***Scanning Tunneling Microscopy***

The scanning tunneling microscope uses a tungsten (W) tip that characterizes samples by tunneling electricity to/from the sample in close range. By moving the probe in a line-by-line raster fashion, a 3-D image can be constructed by applying a bias from the tip to the sample. To produce readings, the sample must conduct electricity. In addition to gaining 3-D maps of conductivity, information on the electronic structure of the sample can be obtained by sweeping voltage and measuring current at a specific location.



Other images:

