Atomic Force Microscope & Scanning Near-field Optical Microscope

Atomic Force Microscope (AFM)

Atomic Force Microscopy is an imaging technique which can measure very small forces when atoms or molecules interact. The principal part of the mechanical device called the cantilever is a plate spring, which is fixed at one end. At the other end it supports a pointed tip. The latter is brought into contact with the sample and moved across the surface in two dimensions. The cantilever deflects as it travels across the landscape (topography). The cantilever deflection is usually detected by a laser beam, which is focused on the cantilever. The movements of the reflected light are observed and monitored by a photodiode detector. This information about the tip movement provides three-dimensional images of the sample. The AFM can achieve a resolution of 10 nm, and unlike electron microscopes can be used with samples in air and under liquid.

In addition to imaging mode, the AFM can detect very small forces between the cantilever tip and a surface on a very fine spatial scale. Measurements can be performed which measure force interactions and variations in forces as tip and surface are moved together and moved apart. The AFM is particularly used for investigation of the strucutre of natural and manufactured nanoaprticles in the aquatic environment.

Scanning Near-field Optical Microscope (SNOM) and AFM

This combined instrument features an AFM along witha Scanning Near-Field Optical Microscope (SNOM). SNOM uses very similar equipment to the AFM, but with an optical light source going through the ‘AFM’ tip. The technique is based on optical microscopy, but measurements in the ‘near-field’ mean that saptial resolution is ca 30-50 nm, rather than 0.5 mm as with most optical microscopy. The microscope works in the ‘near-field’ because the distance between the probe and the sample surface is so much smaller than the wavelength of the light. This means that high resolution optical information is available that is not bound by the far-field diffraction limits.