Features of the Scanning Tunneling Microscope

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Sample of Content:

Classified as a scanning probe microscopy instrument, the scanning tunneling microscope (or STM) is actually a better version of the atomic force microscope. The advantages and details are disucssed here.

Content:

This scanning tunneling microscope (STM) invented by Heinrich Rohrer and Gerd Binnig in the 1980s still manages to do a great job today and competes with more advanced microscope types.

The scanning tunneling microscope is used for studying the surface atoms that are found on various materials. The device is based on a complex process of â€œtunnelingâ€• electrons between the material and the tip of a probe. The tip of the probe is sharp and extremely small and it allows for great precision. However, in order to get the best results, the distance between the tip and the studied material has to be precisely calculated. While the tip is moving on the surface of the material, a constant flow of electrons must be kept so as to get accurate readings. After the scanning tunneling microscope does its job, the researcher is left with a precise bump map of the surface material.

Classified as a scanning probe microscopy instrument, the STM is actually a better version of the atomic force microscope. The scanning tunneling microscope brings higher accuracy and better individual atom separation abilities, providing researchers with high resolution images. Since the size at which experiments can be done is very small (about 0.2 nm) the scanning tunneling microscope offers a lot of versatility in usage. By making the most out of the high resolution images, researchers can manipulate individual atoms on the material surface. This allows for precise chemical and physical reactions to be performed, as well as electron manipulation.

So how does the scanning tunneling microscope work? STMs work by following the guidelines found in quantum mechanics, where the flow of electrons between the surface of the studied material and the tip of the probe is the essence of the experiment. The quantum mechanical effect is represented by the tunneling of electrons, which is, in other words, a transfer of electrons between the surface and the tip of the probe. The jumping motion performed by the electrons and the back and forth motion creates a weak electrical current (which only happens if the studied surface is a conductor). Precise measures of the distance between probe and surface is accomplished by using converse piezoelectricity.

There are many fields of study where a scanning tunneling microscope can come in handy. Researchers use it to get a better understanding of the conductivity level mechanisms found in different molecules. Because it allows for such great precision and individual atom manipulation, the scanning tunneling microscope is often used in labs dealing with nano technology. Other applications where the STM is used include conductivity research as well as analysis of the structural surface of various materials. Electronic device manufacturers use the scanning tunneling microscope as a tool for verifying surface conductivity and improving the size of their electronic devices, and there are numerous other fields where the STM performs accurately.

George Anderson loves the details that can be learned from microscopic study. See his website at http://www.getmicroscopes.com

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