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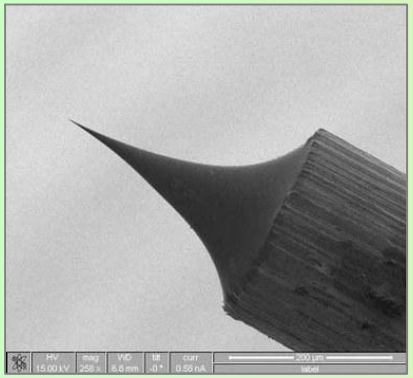
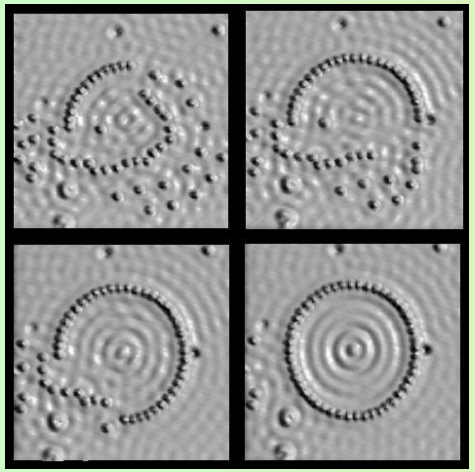
STM Microscope



http://www.mse.engin.umich.edu/research/highlights/electrochemical-etching-of-ultrasharp-tungsten-stm-tips/the_image_bigpop



The scanning tunneling microscope (STM) is an instrument with which one can image surfaces so finely that individual atoms are resolved. The STM can even move atoms about.

http://www.sfc.fr/material/hrst.mit.edu/hrs/materials/public/Corral_construction.jpg

Introduction

Scanning tunneling microscope (STM) is a powerful technique for viewing surfaces at the atomic level.

The scanning tunneling microscope (STM) is a type of electron microscope that shows three-dimensional images of a sample.

In the STM, the structure of a surface is studied using a stylus that scans the surface at a fixed distance from it.

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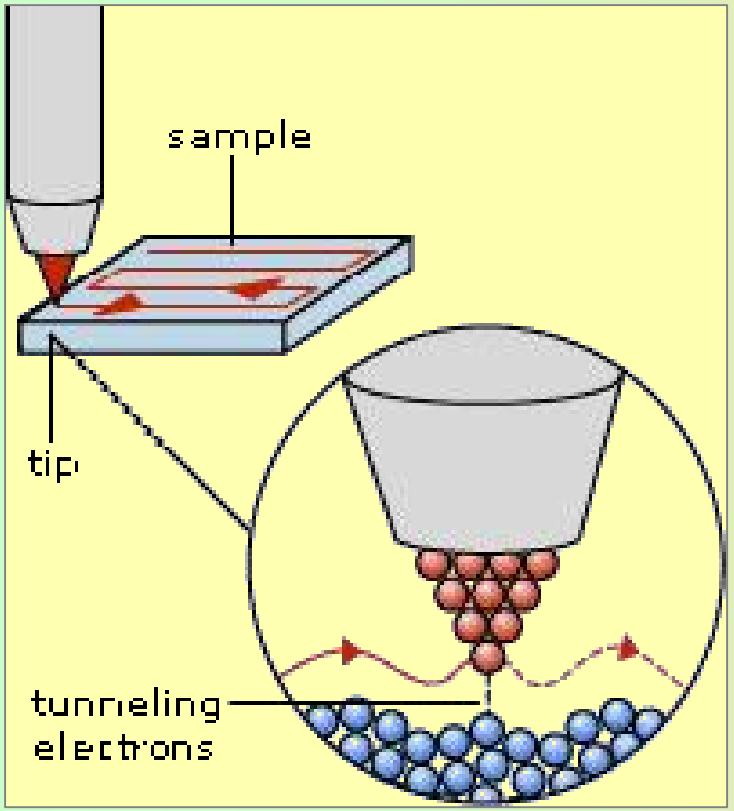

http://nobelprize.org/educational_games/physics/microscopes/scanning/images/stm1.gif

How it works

An STM consists primarily of a needle and a computer.

A needle tip is scanned across the surface of the sample under investigation.

If a small electric potential difference is maintained between tip and sample, then a current will flow between them once the tip gets very close.

The current only flows when the tip-sample distance is of atomic dimensions.

This effect is called the tunneling effect.

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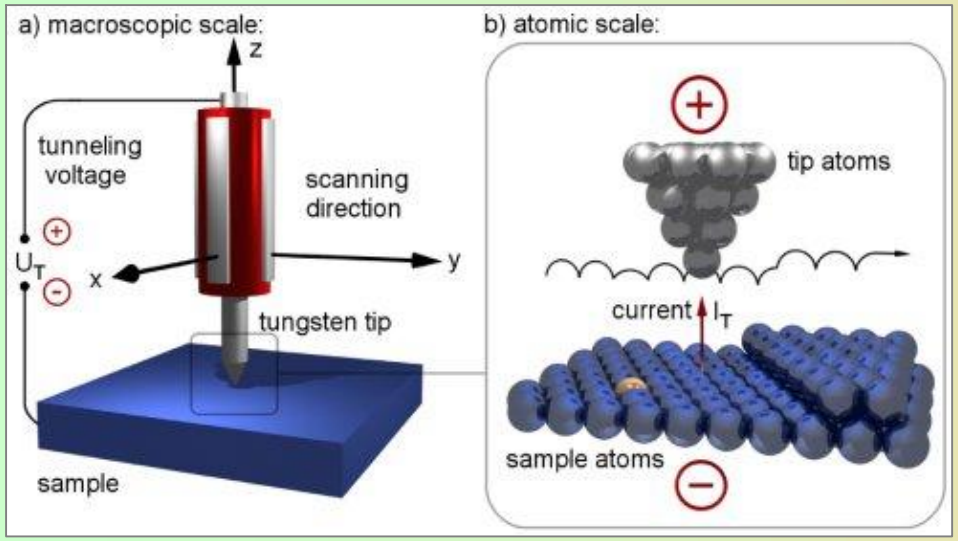
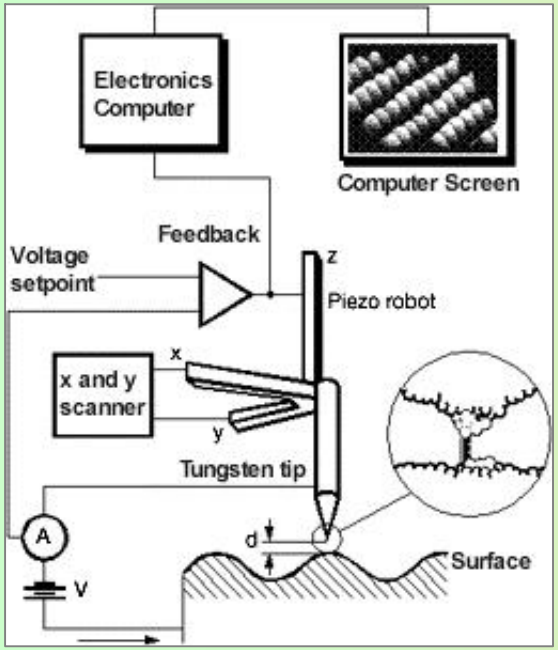


http://www.ieap.uni-kiel.de/surface/ag-kipp/stm/images/stm.jpg



http://dcwww.fys.dtu.dk/~horch/Bilder/STM_Fig_1.gif

How it works

If we now scan the tip across the surface (read the next paragraph to find out how to do that), this current will increase or decrease, depending on the distance of the tip above the surface.

Using a fast electronic feedback, we control the tip-surface distance such, that the current remains constant.

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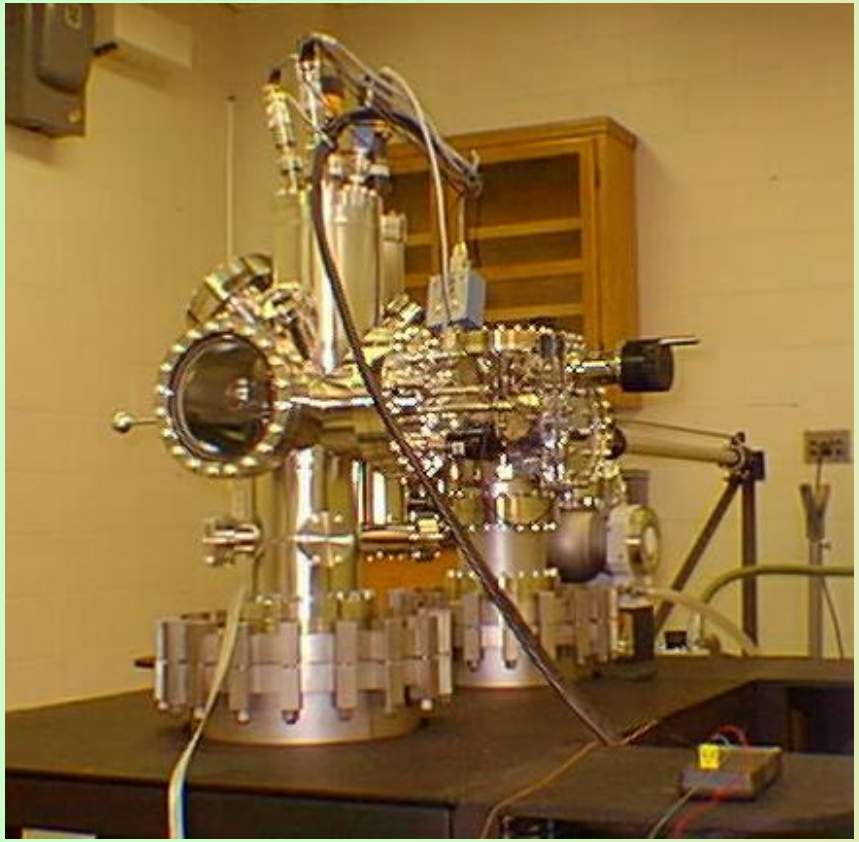

http://www.wfu.edu/nanotech/Microscopy%20Facility/stm_view.jpg

Limitations

The STM works best with conducting materials, but it is also possible to fix organic molecules on a surface and study their structures.

The STM may be conceptually simple, but there are complexities in its use. For instance, a small vibration, even a sound, could smash the tip and the sample together.

The STM needs to be in a vacuum chamber, which isolates it from vibrations. The vacuum chamber also protects against contamination. A single dust particle, for example, could damage the needle.