Atomic force microscopy

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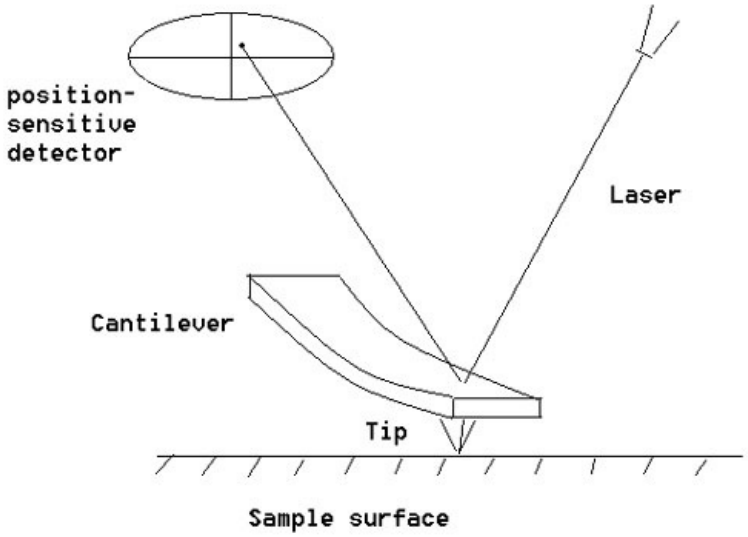
- **Introduction:**

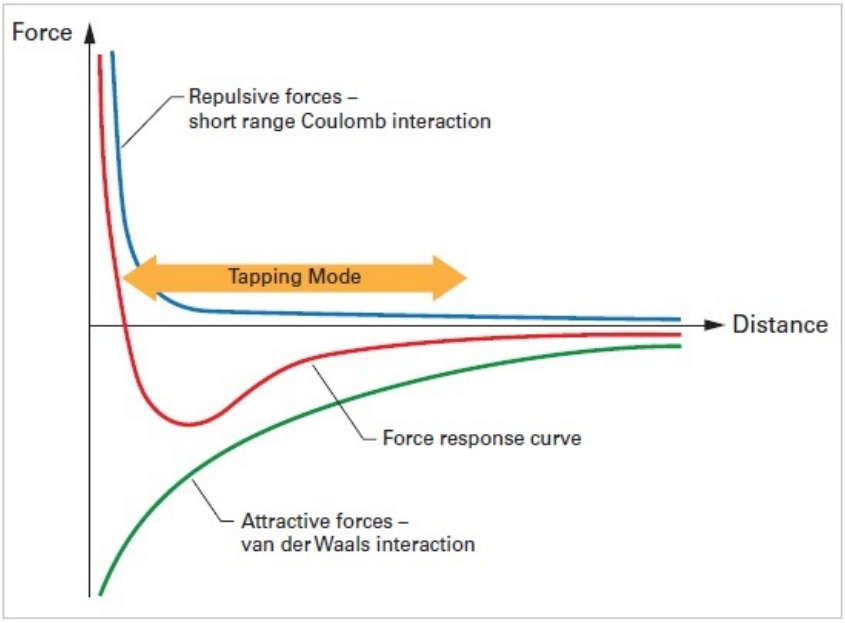
The Atomic Force Microscopy(AFM) or Scanning Force Microscopy(SFM) is a very high-resolution type of Scanning Probe Microscopes(SPM). The AFM can be used for topographical imaging and atomic force measurements. In order to create this image, the AFM scans the spatial structure of the SAMPLE WHILST MEASURING SOME VARIABLE E.G., VAN DER WAALS FORCE.

By describing the principle and mechanism of the Atomic Force Microscopy imaging, we can compare its concept, very simply, to a record player which is reading the surface of a record.

The ATM measures the vertical and lateral deflections of a cantilever by using an optical lever. The optical lever operates by reflecting a laser beam off the cantilever. The reflected laser beam strikes a position-sensitive photo-detector consisting of four-segment photo-detector. The differences between the segments of photo-detector of signals indicate the position of the laser spot on the detector and thus the angular deflections of the cantilever. The deflection ARE A MEASURE OF THE FORCE. A FORCE MAP CAN THEREFORE BE PRODUCED.



Imaging can be accomplished with either contact mode or tapping (ALSO KNOWN AS NON-CONTACT MODE) mode, and both modes can be used in either air or fluid. In contact mode the tip of the cantilever is in constant contact with the sample surface, whereas in tapping mode the cantilever is not, which consequently reduces sample damages. Due to that, the tapping mode is more commonly used for imaging of soft tissues.



- **How does the Cantilever measure the forces?**

The sample is placed on the end of the cantilever (which we can think of a spring). As we know the amount of force between the probe and sample is dependent on the spring constant (stiffness of the cantilever) and the distance between the probe and the sample.

- **Importance in medicine:**

AFM is mainly used in the medical and biological research and is a very powerful technique, allowing samples to be imaged in a native environment of the sample, such as nucleic acids, proteins, membrane structures and whole cells. The ability to explore the mechanical properties of biological materials and surfaces in their native state is essential for a complete characterization of the material and understanding of how biophysical cues influence cell behaviors. Those abilities help to study and understand several diseases and have already been used in many medical researches.

- **Conclusion:**

Due to the enormous number of discoveries that scientists have made over the last 300 years with the help of microscopes, science, especially medicine and biology developed into subjects that are mainly researching in the scale of nanometers. Because of that modern microscopes, in particular the AFM and its ability to image samples in real time in sub-nanometer scale, will be more and more relevant in future.

- **References:**

[1] [2] [3] [4]

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