Atomic Force Microscopy

Name of the student

Affiliated College

Course

Unit

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Theory

Piezoelectric transducer put the sample to be fixed on the fine position on the holder. Cantilever is mounted above the sample on a different holder. This resulting to the interaction between the tip leads to bending of the cantilever. The force which acts on the tip is measure by the deflection which s normally being detected when the when laser beam is deflected by piezoelectric. By moving the scanner there is control of distance of the tip sample which results from signal deflection. The user can control and set constant deflection.

Procedure

1. Insert nose assembly into scanner.
2. Probe into nose assembly scanner into microscope then connect cables.
3. Insert laser with cantilever
4. Insert defector.
5. Prepare sample with amount sample plate.

Others SPM techniques

EFM

The technique relies on the interaction of a probe that is a sharp a tip and a sample surface. Different interactions are used for image formation (Nanotechnology, 2016). They include KFM, MFM, and EFM. Electric Force Microscopy is a counter technique to AFM that deals with interaction of long-range electrical forces (Nanotechnology, 2016). In the method, differences or sample charges are detected in a surface potential. EFM method can be conducted as a single or double pass technique. The tip that allows interaction is created as a capacitor that is formed by tip and sample. Transformations in the capacitance of the tip sample structure are detected by application of external AC signals or static (Nanotechnology, 2016). When conducing the experiment, precaution must be taken as electrical forces are always long-range forces hence limiting resolution to ca (Nanotechnology, 2016).

Kevin Probe Force Microscope (KFM)

The method is highly linked with EFM as it is a regarded as a quantitative EFM that determines the work function of a material (Nanotechnology, 2016). It is usually done with a single pass

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technique through application of external DC voltage to do the nullification of electrical signals that are measured in EFM using the AC voltage that is applied between the tip and the original sample (Nanotechnology, 2016). The presence of no surface charges in KFM is always assumed and a variation in the tip sample that is measured arises in difference in the work function at the tip and sample surface that is contact potential difference (CPD) (Nanotechnology, 2016).

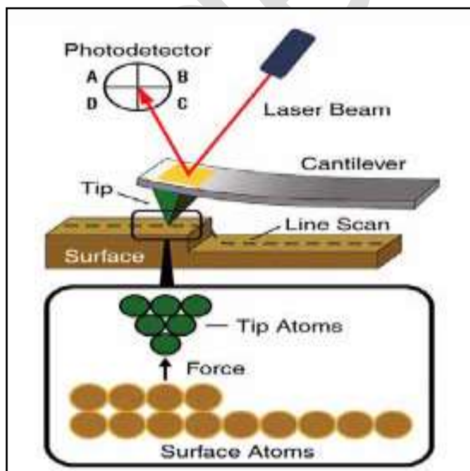
Magneto Force Microscopy (MFM)

It is an AFM based technique that uses magnetic tip. The method is carried out in a two pass technique (Nanotechnology, 2016). A first pass is close to the sample which involves obtaining of AFM image of the sample. The second pass involves the tip following the topography in long distance from the distance of the sample (Nanotechnology, 2016). The fact that magnetic forces are long-range and Vander Walls forces are short range is considered whereby interaction of the sole interaction of the magnetic tip and magnetic domains at the surface takes place (Nanotechnology, 2016).

Discussion

Atomic force microscopy (AFM) was developed when people tried to extend STM technique to investigate electrically non-conductive materials for example proteins. AFM majorly measures the interaction force between the tip and the surface. The tip can vibrate across the surface as it moves or can be dragged. Interaction force depends on the nature of the sample probe tip as well as the distance between them.

Basic AFM Principle



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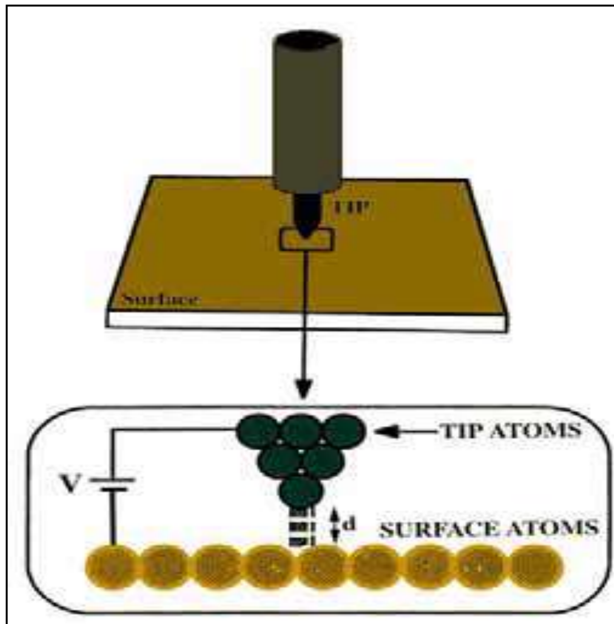
STM on the other hand measures weak electrical current that flows between the tip and the sample. EFM closely relates to AFM as it analyses the long-rage electrical forces instead of analyzing the Vander wail forces. All the above procedures are combined in a single techniqure called Scanning Probe Microscopy (SPM). SPM has a sharp probe that makes it possible for perpetual contact with the sample.

Sample Probe Microscopy



The SPM can also be used as a non-imaging technique or nano-manipulation process.

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Conclusion

Other microscopy techniques have importance but AFM techniques have more advantage compared to all. It is because interaction with the surface allows for measurement of physical properties of the surface. There is also possibility of AFM delivering a 3D photography from the angstrom level to the micron scale. The sample must not be conducive in comparison to STM. AFM technique has capability of manipulating features that are in the surface hence making it appropriate technique. Image resolution is acquisition in AFM takes place through measuring the vertical deflections of the cantilever by utilization of the optical handle. The optical handle works by reflection of a laser beam from the cantilever. The gadget that is reflected will hit a

location on the photo detector which is sensitive and consists of photo detector that has approximately four segments. The variations amid the sections of photo detector that have indications point to the position of the laser mark hence leading to angular deflections on the cantilever. The techniques help AFM the most versatile and powerful technology that is associated with microscopy. AFM provides variety of surface measurements that meet the expectations of scientists and researchers. The technique requires minimum sample preparation hence making it recommended for studying of samples on the nanoscale. AFM is thus a technique that is important in various research processes that deals with samples of various sizes.

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References

Nanotechnology, B. (2016) Available SPM Techniques - LNNano LNNano Retrieved from http://lnnano.cnpem.br/laboratories/mta/techniques/

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