



Environmental Protection and Industrial Applications of Adsorption

Berbezier Vilcot*

Department of Technology, University of Blida, Blida, Algeria

*Corresponding author: Berbezier Vilcot, Department of Technology, University of Blida, Blida, Algeria, E-mail: berbezier@gmail.com

Received date: 19 April, 2022, Manuscript No. JNMN-22-67425;

Editor assigned date: 21 April, 2022, Pre QC No. JNMN-22-67425 (PQ);

Reviewed date: 05 May, 2022, QC No. JNMN-22-67425;

Revised date: 12 May, 2022, Manuscript No. JNMN-22-67425 (R);

Published date: 19 May, 2022, DOI: 10.4172/2324-8777.1000341

Description

Atomic Force Microscopy (AFM) is used to observe the Punica granatum carpellary membrane topography and also to determine its elastic properties. Mechanical properties are studied to improve the knowledge of the carpellary membrane, and how its relative value of elasticity varies from one zone to another. AFM is the only technique that allows determining local elastic properties. AFM makes possible the measurement of the force between the probe and the sample, at any point of the sample, as a function of the displacement, where the displacement is varied using a piezoelectric crystal. Contact mode is used for these determinations. AFM three-dimensional images are obtained and compared with SEM images.

Flat Substrates

Atomic force microscopy, which was introduced some years ago, attracted the initial attention of scientists by its capabilities to generate topographic surface maps with unique resolution and to visualize atomic-scale lattices of crystalline samples. By learning more about force interactions between a sharp tip and a sample surface, which are used for probing surfaces in AFM, and about the ways to control them, considerable progress in AFM applications to polymer materials was achieved. Today, visualization of single polymer molecules is a routine procedure for examining macromolecules conformation, molecular weight, and their self-assembly on flat substrates. AFM studies of crystalline polymers are leading to the advanced understanding of crystal organization in the nanometer scale. The spectrum of AFM applications to polymers is not limited by high-resolution imaging of their surfaces. Imaging of surfaces of heterogeneous polymer systems such as block copolymers and polymer blends at elevated tip-sample forces allows compositional mapping of these materials, which is primarily based on differences of mechanical properties of individual components. Further, in examination of polymer materials with a rubbery-like topmost layer an AFM probe can penetrate underneath this layer and can visualize polymer organization at different depths. This shows that AFM is not only a surface technique. To prepare bulk polymer samples for AFM, one can use a microtome, which is routinely applied for transmission electron microscopy (TEM).

At present, the expansion of AFM applications to polymer materials includes imaging at different temperatures and improvements in quantitative image analysis. Progress in both areas will further

improve analytical capabilities of this method and will make it an invaluable addition to the family of characterization techniques applied in the analysis of polymers. AFM of polymers will also benefit from instrumental developments aimed at more sensitive control of tip-sample force interactions and on the introduction of new probing interactions (thermal, IR) for chemical-sensitive imaging. AFM is one of the newest techniques for the characterization of surface morphology. The information provided by AFM does not duplicate that of SEM but is generally quite complementary. SEM photos can be used to study surface features that are several tenths of a nanometer while the resolution of AFM is less than 0.1 nm. Therefore, AFM has the ability to distinguish objects on smooth surfaces of molecular dimensions. In fact, under optimum conditions atomic force microscopy has been able to attain resolution on the atomic scale. The highest resolution is achieved for surfaces such as pure metals used for electrodes or for silicon materials used in semiconductor devices.

Scanning Tunneling Microscopy

The principle of AFM is based on the design originally developed for Scanning Tunneling Microscopy (STM). In STM, a current develops between an electrode and a cantilever as a result of deflection caused by interaction between the probe tip and the surface. In order for a response to be measured, the surface must be conductive. AFM utilizes coulombic or van der waal's forces between the surface and the probe tip on the cantilever as a means of investigating surface features. The movement of the cantilever is converted into images as the probe is rastered across the surface. The choice of probe tip material is important so that a suitable response can be generated as the surface is scanned. Considerable effort has also gone into techniques which can make the probe as sharp as possible in order to obtain the highest resolution.

For separation materials, AFM has recently proved to be an effective method for studying the inner walls of fused silica capillaries used in capillary electrophoresis. Under the high magnification of AFM, the apparently smooth surface of a bare unmodified capillary displays a variety of defects. There is much interest in coating silica capillaries in order to control electroosmotic flow or to prevent the adsorption of certain species, usually peptides and proteins, on the inner wall. AFM has been used to monitor the homogeneity of the coating under various reaction conditions. It was possible to correlate the best images with respect to the uniformity of the coating in the capillaries to the deposited layer of highest stability and the greatest reduction in electroosmotic flow. As with SEM, AFM has also proved useful for detecting the presence of adsorbed proteins on capillary surfaces. An important aspect of AFM that distinguishes it from SEM is its ability to determine the depth of surface features. An example of an AFM photo of a bare fused silica capillary that reveals the surface morphology is shown. From a depth profiling analysis on this micrograph, it was determined that some of the grooves visible on this surface were as deep as 500 nm. An examination of a Polyacrylamide capillary revealed a fairly smooth surface at a maximum resolution of 10 nm. Some irregularities were seen but depth profiling revealed that changes in vertical elevation were not greater than 50 nm. The cause of these irregularities was attributed to the roughness of the original fused silica surface. While it has been possible to study fairly smooth structures by AFM, the large irregularities of porous silica material have prevented to date any high resolution images of these surfaces. However, the inner walls of etched fused silica capillaries have been

imaged by AFM so that it seems possible to characterize materials with reasonably rough surfaces. The use of Atomic Force Microscopy for the characterization of oxide materials is still limited but the high resolution capabilities of the method show promise for the study of a

wide variety of surfaces. Both the principles of the technique and the instrumentation must be advanced so that a wider range of morphologies can be studied with resolution approaching that achieved at present on relatively smooth surfaces.