Imaging and Spectroscopy of Molecular Nanostructures

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Abstract

To bring any electronic grade material closer to device integration it is imperative to read-and-record their structure-function rapport under standard laboratory conditions. The need for implementing go/no-go tests with high information content is becoming increasingly important especially for semiconducting nanostructures which comprise just a few atoms. In this talk, I will present the capabilities of scanning probe microscopy towards imaging and spectroscopy of potential nanomaterials from functional organic molecules, polymer wrapped semiconducting nanotubes to two-dimensional atomic crystals, all potential components in next generation electronics. The importance for striking the apt balance between metrological precision and technological relevance when designing and implementing imaging experiments will be outlined. Furthermore, the effect of surface and local chemical environment on the measured energy gaps of molecular nanostructures will be discussed. In addition to applying probe microscopy techniques for investigating electronic grade materials it is also known that such techniques can be applied to evaluate the morphology and functionality of biological samples such as proteins and cells. Finally, a summary of practical challenges for nanoscale imaging of amyloidogenic proteins implicated in the pathology of neurodegenerative diseases, along with the emerging trends in combining molecular imaging and machine learning for data analysis will be presented.

Suggested Reading:

1. Nanoelectrical analysis of single molecules and atomic-scale materials at the solid/liquid interface. Nature Materials, 2014, 13, 10, 947-953.
2. Scanning probe microscopy. Scientific American, 4, 261, 1989.
3. Atomic force microscopy as a multifunctional molecular toolbox in nanobiotechnology. Nature Nanotechnology, 2008, 3, 6, 261.