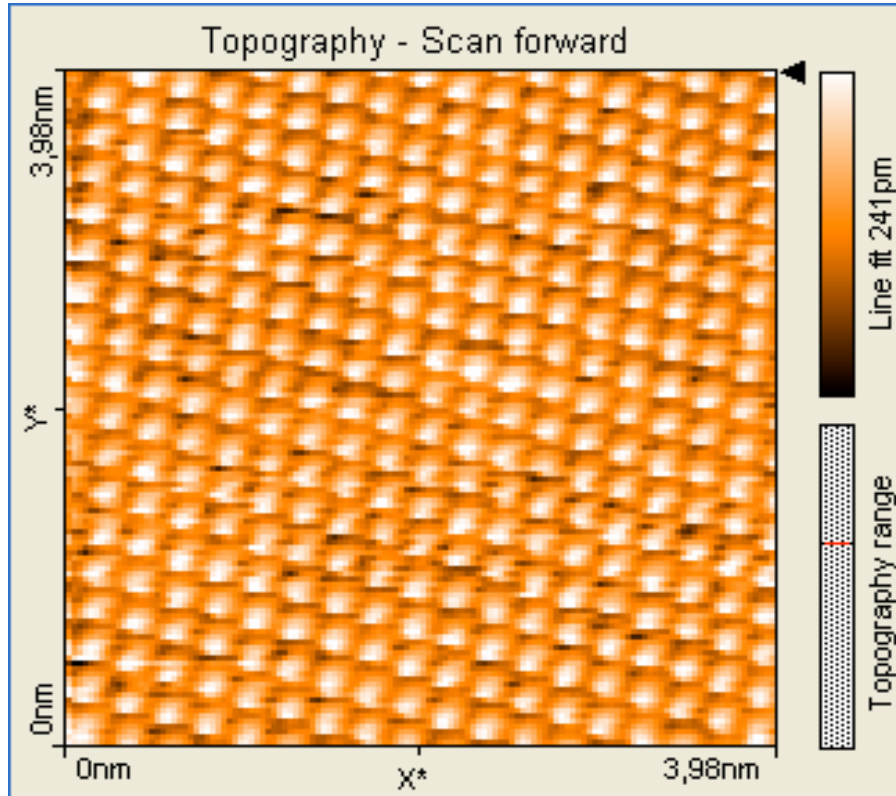


UNDERGRADUATE AWARD INTERIM REPORT



PROJECT: STM STUDIES OF VIRAL NANOWIRES

Project Advisor: Prashant Sharma

Nanostructures on Graphite

Introduction

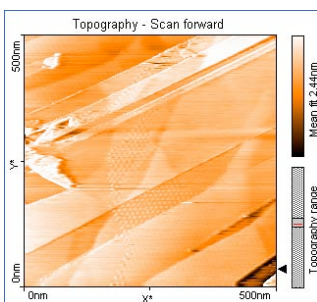
Suffolk University SPS Chapter is interested in Scanning Tunneling Microscope (STM) studies of nanoparticles bound to bacteriophages (few nanometers in diameter) and organized on the surface of graphite--viral nanowires. To begin work on this project we need to understand how the surface of graphite actually looks with our STM (Nanosurf EasyScan2 shown in the left-most photo below) so that we can distinguish the viral nanostructure from the underlying graphite structure. This work forms the initial half of the SPS Project and lays the groundwork for observing viral nanowires.

Nanostructures on graphite

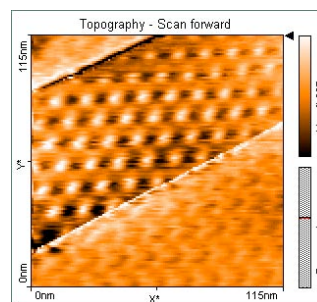
We worked with the commercially available high quality cleaved graphite (HOPG) and used Pt/Ir wires (of diameter 0.25 mm) to form sharp (10-100 nm wide) tips by mechanically cleaving the wire as well as by electrochemically etching it and polishing the resulting sharp tip. Some of the resultant images from the best tips are shown below at two different magnifications. Comparing these to the image on the front page of this report two things can be easily discerned: (i) the center image shows bands of varying colors which is a way of visualizing different heights (corrugation) on a graphite surface; (ii) the single layers of graphite on different steps overlap resulting in an interference pattern images by the STM. This is seen both in the center image (where hexagonally arranged dots are seen across multiple steps) and in the close-up image on the right. The right-most image shows hexagonal patterns with lattice spacing more than ten times the lattice spacing of actual graphite lattice (front page image). Understanding these interference Moire' patterns forms another interesting project and we are still debating whether to do this concurrently with the original planned project or to plan it as a separate project. The problem is one of resources, as one student (Nick Hennigar) has graduated this May and his experience in handling the equipments will be missed next semester.



Nanosurf EasyScan2



Steps and overhangs on graphite surface



Superstructure on graphite (Moire' pattern)

Financial Report

\$420 Gold Nanoparticles; \$200 HOPG samples; \$75 Pt/Ir Wire

Conclusion and Future Plans

The plan for the next several months is to first image gold nanoparticles on graphite surface and try to see how the unevenness of the cleaved graphite surface (that lead to the observation of Moire' patterns) affects their distribution. Then we will use the bacteriophages bound to gold nanoparticles and observe their self-assembly on graphite surfaces.