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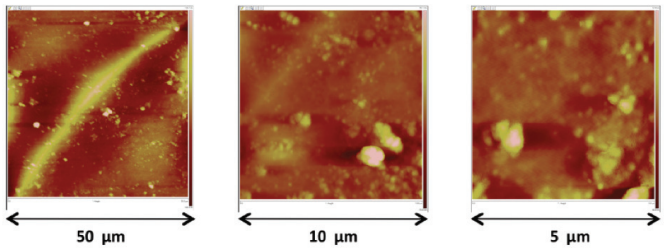
The Future of Energy: Analyzing the Topography of Solar Cells

Student researcher: Amanda Parry, Senior

Current research involving solar panel technology focuses on improving the panels' efficiency, which is their ability to convert energy from sunlight into usable electricity. The efficiency of the first stage of solar panels, the surface that absorbs energy from the sun, relies heavily on the panels' surface structure. The goal of this research was to characterize the surface structure of both a crystalline panel and an organic panel. A correlation between surface structure and surface absorption efficiency may then be shown. Atomic force microscopy (AFM) was used to characterize the surface topography of the panels. AFM, a type of scanning probe microscopy, enables the imaging of surfaces at the nanoscale. Measurements of the surface roughness were used to calculate the surface area available to collect energy for both panels. Comparing the area measured to the projected area, there was a 1.26% difference for the organic panel and a 2.74% difference for the crystalline panel. The percent differences in surface area correlate to the general efficiencies for both types of panels of about 9% for organic panels and about 15% for crystalline panels. A better understanding of solar panel surface structure may lead to the design of more efficient solar panels. This research provided an initial investigation using AFM into solar panel surface topography including commercial (crystalline) and research-based (organic) technology. It also provided this undergraduate student with an interesting and productive research experience.

Research advisor Helen A. McNally says, "Amanda has a natural talent for research. She had a clear motivation, grasped the concepts and operation of the AFM very quickly, and completed the project with analysis and documentation. Working with Amanda was a pleasure, and I look forward to her amazing future!"



Images produced using AFM of the Solarex crystalline panel.

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