Probing Nanointerfaces of Nanoparticle-Based Solar Energy Conversion: Molecular Dynamics on the Angstrom Scale

RICHARD OSGOOD\(^2\), Columbia University, Laboratory for Light-Surface Interactions, Center for Integrated Science and Engineering

Charge-induced surface chemistry following solar-illumination of nanometer-scale semiconductor particles is one possible route to low-cost solar energy conversion. Because of their high surface to volume ratio interfaces play a major role in the performance of this technology and thus the physics of charges interacting with adsorbed molecules is of central interest. In this talk, after a brief review of related work, we will focus on our advances in understanding molecular-dissociation-dynamics at the interface of nanometer-scale TiO\(_2\) crystals and large organic molecules. Clearly the standard probes of beam-based molecule dynamics are not easily adaptable to small nanointerfaces. Instead our work uses STM imaging to examine dynamics of fragments following tip-induced electron injection into organic molecules on TiO\(_2\) (110) and on \(\sim 10\) nm nanocrystals (110). Our experiments have used halogenated anthracene to probe the efficiency and fragment trajectory following dissociative electron capture. Our work has examined nanoparticle synthesis, adsorbate-molecule orientation, thermal and injected-electron chemistry, and adsorbate charge-mediated fragmentation trajectories.

\(^1\)DOE Grant NO. DE-FG02-90ER14104
\(^2\)Second author: Denis Potapenko