



Columbia University



IGERT and Quantum Electronics Seminar

“Light-powered chemistry on pristine single and nanocrystal TiO_2 surfaces”

Dr. Denis V. Potapenko

*Department of Applied Physics and Applied Mathematics
Columbia University*

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Location: Sindeband East 414, CEPSR



Abstract: Understanding of the behavior of photo-generated electrical charges at the interface of the semiconductor is crucial for renewable solar-energy technologies such as photocatalysis and photovoltaics. In our laboratory we explore the charge-induced phenomena on the surface of a semiconductor on a single-molecule scale using Scanning Tunneling Microscopy (STM) as our primary research tool and titanium dioxide (TiO_2) as a model photo-active semiconductor. TiO_2 is a versatile photocatalytic material and it has been the subject of extensive research over the last two decades. We have studied both single-crystal rutile(110) surface and arrays of TiO_2 nanocrystals prepared in situ on an Au(111) surface. Photo-induced desorption tri-methyl acetic acid (TMAA) molecules adsorbed on TiO_2 surfaces has been selected as a model photocatalytic reaction. By using monochromatic light from a UV-vis lamp to drive the surface photoreactions, we demonstrate strong dependence of the reaction rates on both the wavelength of the incident light and the state of the surface. The TiO_2 nanocrystals are shown to be also photoactive for desorption of TMAA from an ordered template. Finally experiments to investigate the electron- and hole-induced chemistry on rutile(110) surface by injecting charges from the STM tip directly into an adsorbed molecule or into the substrate are reported.

Bio: Denis V. Potapenko has earned his M.S. degree in Applied Physics from Moscow Institute of Physics and Technology (MIPT) and his Ph.D. in Chemistry from Rutgers, the State University of New Jersey. He has been working in different areas of the chemistry of surfaces, specializing in the field of nano-catalysis. After finishing postdoctoral studies at Brookhaven National Laboratory (BNL) in 2006 Denis has joined Prof. Osgood's research group at Columbia University as a Research Scientist.

Hosted by Prof. R. Osgood • For further information: call 212 854 4462, ss4198@ee.columbia.edu