O 105: Overview Talk: Melissa Hines

Time: Friday 9:30–10:15 Location: TRE Phy

Invited Talk O 105.1 Fri 9:30 TRE Phy

The Surface Chemistry of Anatase (001) and Rutile (110) in Solution: Atomically Flat Surfaces and Near-Ideal Organic Monolayers — •Melissa Hines — Cornell University, Ithaca NY, USA

The surface chemistry of TiO2 – a sustainable, earth-abundant, non-toxic metal oxide – has garnered attention due to many high-profile applications, including dye-sensitized solar cells and photoactivated H2O purification; however, relatively little is known about the surface chemistry of TiO2 in technologically relevant environments, such as air and solution. This ignorance is perhaps best illustrated by our recent discovery that rutile surfaces under ambient conditions are not terminated by a H2O film as long assumed, but rather by a tightly bound, self-assembled monolayer of bicarbonate formed by the catalytic reaction of CO2 and H2O. We have developed solution processes to produce atomically flat rutile (110) and heteroepitaxial anatase (001), both with the size and quality necessary for characterization by STM and IR spectroscopy. Using these, we have prepared, imaged, and analyzed a variety of near-atomically-perfect, self-assembled monolayers from solution. The structure and photoreactivity of these monolayers provides insight into their function. For example, strong π-π interactions between phenyl rings in benzoate monolayers induce intramolecular rotations that destroy the extended π conjugation between the phenyl and carboxylate groups, presumably disrupting electron transport. STM also shows that anatase surfaces prepared in solution are very different from those prepared in UHV.