

## Making Functional Surfaces and Thin Films: Where are the Atoms?

Key goals of condensed matter physics are to understand how materials behave and how new materials or material structures can be developed to meet societal needs. Structure plays a key role in determining the properties of materials and x-ray scattering (aka x-ray diffraction) plays a key role in determining how atoms are arranged and move in materials. In the past few decades, x-ray sources, particularly synchrotron x-ray sources, have been advancing at an unprecedented rate, enabling x-ray scattering studies of materials evolution that were impossible. We are using synchrotron-based x-ray scattering to investigate how material structure evolves, especially during thin film growth and surface modification processes of potential technological importance. In addition, we have begun using the world's first hard x-ray laser, the Linac Coherent Light Source at SLAC, to investigate much faster materials processes, such as atomic motion in liquid.