Self-organization of atomic and molecular ensembles on surfaces allows for fabrication of nano-systems having feature size and atomically controlled interfaces that are typically unattainable using lithographic techniques. In my laboratory, we have developed self-organization techniques using both atomic structure on crystal templates and localized chemical reactions on substrates in order to fabricate functional molecular scale systems. We have designed simple methods to fabricate biomimetic membranes that are translatable to automated array fabrication. This will enable high-throughput electrochemical analysis of protein-membrane interactions. We have also designed metal nanoassemblies with atomic scale core shell structures for fundamental understanding of heterogeneous catalysis and with architectures having molecular scale inter-particle spacing in order to achieve enhanced optical fields on surfaces for increased performance in sensors and solar cells. We have been able to scale down state of the art assembly methods of metal nanoparticles on surfaces by an order of magnitude using covalent-substrate interactions. The synthesis processes are designed to be compatible with large-scale manufacturing processes in order to enable future device integration. I will present these novel self-organization synthesis routes followed by characterization of physical, electronic and optical properties using scanning probe based techniques.

Biosketch
Prof. Regina Ragan received her B.S. summa cum laude in Material Science and Engineering in 1996 from the University of California, Los Angeles and Ph.D. in Applied Physics in 2002 from the California Institute of Technology. From 2002-2004 she was a postdoctoral research scholar in the Information & Quantum Systems Laboratory at Hewlett Packard. Since 2004, she has been an Assistant Professor of Chemical Engineering and Materials Science at the University of California, Irvine. Her research interests include both fundamental understanding of physical properties as feature size research molecular length scales and understanding thermodynamic processes governing rational assembly of nanostructures on molecular length scales. She is a recipient of the National Science Foundation Faculty Early CAREER Award.