Title: Nanopatterning with Polymer Thin Films

Abstract: Polymer thin films are essential for patterning microelectronics circuitry with lithographic processes. Our work explores the physical and chemical processes that drive pattern formation in two material classes that are relevant to next-generation lithography. First, I will discuss reaction kinetics in chemically-amplified photoresists (CARs), where pattern formation is based on the acid-catalyzed deprotection of glassy polymer resins. Through a concerted experimental and modeling effort, we determined that reaction front propagation is controlled by an anomalous (subdiffusive) catalyst transport mechanism. Such behavior is associated with dynamic heterogeneities in the glassy film, which should be considered when developing high-resolution materials and predictive lithography models. Second, I will describe nanopattern formation through block copolymer (BCP) self-assembly, a potentially inexpensive alternative to traditional lithographic approaches. Using detailed synchrotron scattering experiments, we find that interactions between the BCP and underlying substrate control defect densities, domain shapes, and domain orientations. These data demonstrate that high precision patterning by BCP self-assembly requires new strategies to formulate and define polymer-substrate interfaces.

About the speaker: Gila Stein earned her B.S. in Chemical Engineering at Drexel University (2002) and completed a Ph.D. in Chemical Engineering at the University of California, Santa Barbara (2006). She then moved to the National Institute of Standards and Technology, where she was a NRC postdoctoral fellow in the Center for Nanoscale Science and Technology (2007-2008). Since 2009, she has been an Assistant Professor in the Chemical and Biomolecular Engineering department at the University of Houston. Dr. Stein's research group studies the physics and chemistry of thin polymer films, emphasizing applications in the microelectronics industry. She received a NSF CAREER award in 2012.