Chemical Co-Patterning Strategies Using Azlactone-Functionalized Polymers

Mohammadali Masigol[1], B.S. Lokitz[2], S.T. Retterer[2], R.R. Hansen[1,*]

[1]*Chemical Engineering Department,*
Kansas State University, Manhattan, KS 66506
[2]*Center for Nanophase Materials Sciences,*
Oak Ridge National Laboratory Oak Ridge, TN 37831
**rrhansen@ksu.edu*

Interfaces can be modified with azlactone-functionalized polymers in order to manipulate the chemical surface reactivity. Azlactone groups are highly reactive, specifically towards amine, thiol, and alcohol nucleophiles, thus providing a versatile coupling chemistry for secondary surface modifications. Numerous applications, including chemical and biological capture and sensing, cell culture, and nanolithography, require that azlactone polymers are co-patterned within a chemically or biologically inert background. Many traditional chemical co-patterning methods degrade the azlactone groups during processing steps or result in polymer films with poorly controlled film thickness. We have recently developed new patterning strategies that generate well-controlled, brush-like polymer patterns while preserving the azlactone functionality in the polymer, as well as the background chemistry.

In this poster presentation, we will present and compare top-down and bottom-up strategies for generating uniform, micro to nano-scale patterns of the block copolymer, poly(glycidyl methacrylate)–*block*–poly(vinyl dimethyl azlactone) (PGMA-*b*-PVDMA) within chemically inert (fluorosilane) or biologically inert (polyethylene glycol) backgrounds. First, a top-down approach that uses a parlyene-liftoff mask to preserve background surface chemistry is detailed. Here, the thickness of the parylene mask was found to influence the resulting PGMA-*b*-PVDMA film thickness and uniformity. A second approach uses reactive silanol groups lithographically patterned into a chemically inert background for the interface-directed assembly of PGMA-*b*-PVDMA. This approach results in the generation of uniform, brush-like structures and intact azlactone groups. Finally, results detailing PGMA-*b*-PVDMA microcontact printing onto protein-resistant background layers is presented. The advantages and drawbacks of each co-patterning method will be discussed, and the design and development of these patterned surfaces on sensor interfaces for capture and separation of bacterial pathogens will also be detailed.

Figure 1. (A) Micro-patterned block copolymer (PGMA-b-PVDMA) on silicon interfaces. (B) Block copolymer interfaces after functionalization with bioreceptors (green).