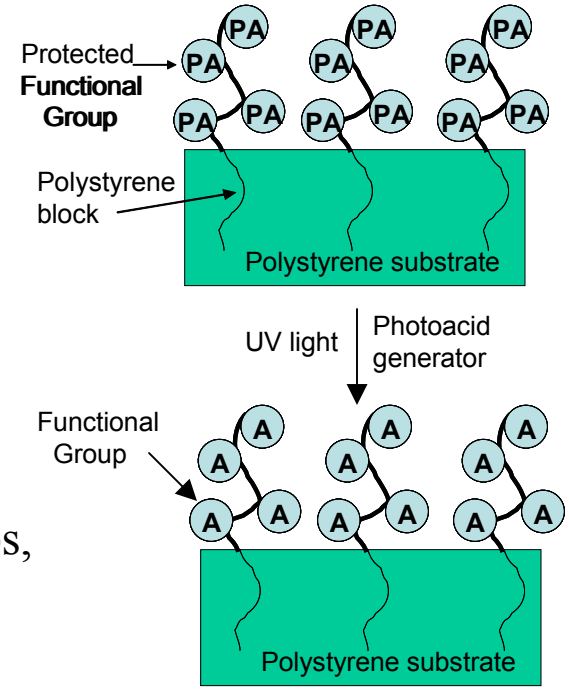
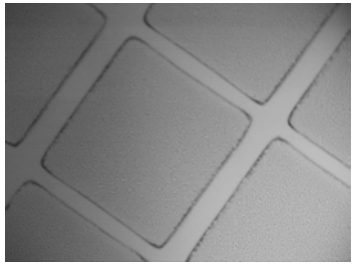
# Photochemical Modification and Patterning of Polymeric Substrates

Jeff Koberstein, Columbia University, DMR-0214363

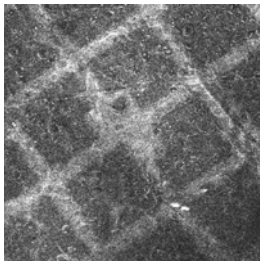
Many polymer applications require precise control of surface chemistry to obtain appropriate surface properties. Delivering reactive functional groups to surfaces has long been a problem. We have developed smart block copolymers with photoactive functional groups that can be coated as monolayer brushes onto polymeric substrates using supercritical fluids. The modified surfaces possess minimal adhesion until activated with light, whereupon reactive chemical groups are formed. Illumination through a mask allows for patterning of surface functional groups, an important tool in preparing substrates for microelectronics or sensors, e.g. protein microarrays. The technique retains the full resolution of UV photolithography and is more direct than competing micropatterning technologies such as stamping.



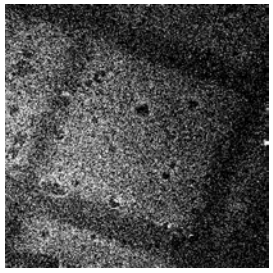

Polymer substrate coated with supercritical CO2 a photoactive block copolymer; functional groups form when exposed to UV light.



Polystyrene substrate (left) patterned with surface carboxylic acid groups on a 250 μm grid.



Fluorescent microscope image (right) showing molecular recognition of fluorescently tagged streptavidin to biotin that has been covalently attached to surface patterned carboxylic acid groups (left) .



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**Education:**

Two graduate students (Danielle Lewis, supported in part by an IGERT fellowship, and Peng Wang) have contributed to this project. In addition, in Spring of 2003, three undergraduates (Goonjun Shah, Josh Meisner and Indira W) met as a reading group once a week with the PI on a volunteer basis without credit in order to learn about biomaterials. The experience culminated in student presentations to the PI's research group. Two of the students served research internships in the PI's labs for the summer of 2003 as part of an IGERT program. All three of the students are currently pursuing independent research projects with the PI .

**Outreach:**

As a professor in residence living with students in the Lerner Living and Learning Center, the PI has organized an informal lecture series "Society and Technology" in which eminent professors and undergraduates share dinner and an evening in the PI's apartment to discuss current issues of technological importance.

The PI in his apartment discussing the role of polymers in society with undergraduates