A Mild Photoactivated Hydrophilic/Hydrophobic Switch

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Abstract

Surface modification using light is one of the most powerful methods for controlling the physical and chemical properties of functionalized surfaces. In this paper, we report on systems where soft UV irradiation (λ = 365 nm) converts a “low” activity fluorocarbon to a “high” activity amine-functionalized surface. An amine-functionalized SAM (self-assembled monolayer) is first masked using a tertiary amine catalyzed reaction with an N-hydroxysuccinimidyl carbonyl reagent. This mild, room-temperature reaction introduces a hydrophobic photocleavable nitrobenzyl “protecting group” terminated with a fluorocarbon end-chain. UV irradiation (λ = 365 nm) of this hydrophobic/fluorocarbon surface cleaves the nitrobenzyl residue, returning the surface to the original hydrophilic/amine-functionalized state. This provides a mild, generic method of producing surfaces with hydrophilic/hydrophobic patterns or patterned with amine functional residues. Two different protecting groups, one terminated with a single and the other with three fluorocarbon end chains, are compared. In the case of the more bulky protecting group, only a small proportion of the amine residues react, but the surface is equally hydrophobic and the amine residues equally well shielded from further reaction. Surfaces are characterized by X-ray photoelectron spectroscopy, ellipsometry, surface potential, and contact angle measurements. Images of the photopatterned SAMs were obtained using scanning electron microscopy.