

Micro- and nano-structured poly(oligo(ethylene glycol)methacrylate) brushes grown from photopatterned halogen initiators by atom transfer radical polymerization.

ABSTRACT

Photolithographic techniques have been used to fabricate polymer brush micro- and nanostructures. On exposure to UV light with a wavelength of 244 nm, halogens were selectively removed from films of chloromethylphenyltrichlorosilane and 3-(2-bromoisobutyramido)propyl-triethoxysilane on silicon dioxide. Patterning was achieved at the micrometer scale, by using a mask in conjunction with the incident laser beam, and at the nanometer scale, by utilizing interferometric lithography (IL). Friction force microscopy images of patterned surfaces exhibited frictional contrast due to removal of the halogen but no topographical contrast. In both cases the halogenated surface was used as an initiator for surface atom-transfer radical polymerization. Patterning of the surface by UV lithography enabled the definition of patterns of initiator from which micro- and nanostructured poly[oligo(ethylene glycol)methacrylate] bottle brushes were grown. Micropatterned brushes formed on both surfaces exhibited excellent resistance to protein adsorption, enabling the formation of protein patterns. Using IL, brush structures were formed that covered macroscopic areas (approximately 0.5 cm²) but exhibited a full width at half maximum height as small as 78 nm, with a period of 225 nm. Spatially selective photolytic removal of halogens that are immobilized on a surface thus appears to be a simple, rapid, and versatile method for the formation of micro- and nanostructured polymer brushes and for the control of protein adsorption.

Keyword: POEGMA Brushes; Micro; Nanostructured.