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Modification of Polymer Surfaces and the Fabrication of Submicron−scale Functionalized Structures by Deep−ultraviolet and Electron−beam Lithography

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Abstract

A general technique to modify polymer surfaces using N−hydroxysuccinimide (NHS) functionalized perfluorophenyl azides (PFPAs) is presented. Thin polystyrene films are spin−coated with a solution containing the NHS PFPA ester and are either ultraviolet (UV) photolyzed with a dosage of 10 mJ□cm−2 or exposed with a 15 kV electron beam with a dosage between 1 and 75 μC□cm−2. The NHS active ester groups become covalently attached to the polymer via photogenerated or electron beam generated, highly reactive nitrene intermediates derived from the PFPA. Using this technique, it is demonstrated that well−defined surface regions can be functionalized with a minimum observable feature size of 0.5 and 0.2 μm for UV and electron−beam exposure, respectively. Through reaction of the functionalized surfaces with primary amine−containing reagents, biological molecules have been installed on the polymer and the activity of an immobilized enzyme has been measured.