(Bio)Functional Polymer Surfaces generated via Surface-Initiated, Controlled Radical Polymerization

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Abstract: This contribution will discuss the use of polymer brushes prepared via surface-initiated atom transfer radical polymerization (SI-ATRP) as platforms for the fabrication of (bio)functional surface coatings. The presentation will consist of two parts.

The first part of the presentation will discuss three examples of the use of SI-ATRP to generate (bio)functional polymer brushes. As a first example, poly(poly(ethylene glycol)methacrylate) (PPEGMA) brushes will be presented, which provide a thin polymer layer that is not only resistant towards the non-specific adsorption of proteins, but which also contains hydroxyl groups that can be used to covalently immobilize proteins or small peptide ligands. Functionalization of these brushes with benzylguanine allows the covalent, chemoselective immobilization of O6-alkylguanine-DNA-alkyltransferase (AGT) fusion proteins, which can be used to detect protein-protein interactions. In a second example, it will be shown that modification of PPEGMA brushes with short RGD-based cell adhesion peptides provides surface coatings, which are able to induce integrin-specific adhesion of human umbilical vein endothelial cells (HUVECs) and which may be of interest as coatings to promote endothelialization of blood contacting biomaterials. Finally, a novel approach for the fabrication of microstructured calcite thin films will be presented. The process uses photolithographically patterned poly(methacrylic acid) (PMAA) brushes grown via SI-ATRP as ionotropic matrices to produce crystalline calcite films that are an exact 3D replica of the PMAA brush. While the lateral dimensions of the microstructured calcite film are defined by the lithographic techniques that are used to prepare the micropatterned PMAA brush, the thickness of the films can be adjusted via the thickness of the PMAA brush, which can be controlled due to the “living” nature of the SI-ATRP procedure.

The second part of the presentation will focus on chemistry and will demonstrate some novel approaches to graft polymer brushes via SI-ATRP from surfaces other than glass and silicon, which are most commonly used, but not always most relevant from an application point of view.

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