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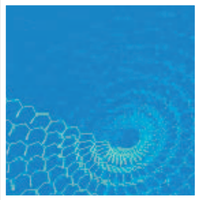

Polymer and Colloid Highlights

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Diagnostic and Sensory Polymer Brushes

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Polymer brushes are thin coatings in which individual polymer chains are tethered by one of their chain ends to a substrate (Fig. 1).[1] Amongst the various strategies that are available for the synthesis of polymer brushes, surface-initiated atom transfer radical polymerization (SI-ATRP) represents an attractive strategy to prepare dense polymer brushes with precise control over thickness, composition and architecture.

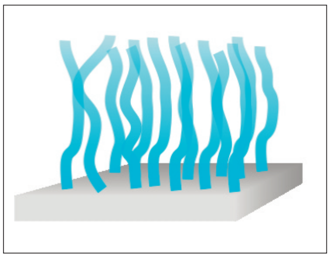

Fig. 1. Schematic illustration of a polymer brush.

Compared to thin organic films, such as self-assembled monolayers, polymer brushes have a high surface density of functional groups, which can be tuned by varying film thickness. As they are relatively thick, the brushes also present an internal volume that is available for binding and recognition. As illustrated below, these features are attractive for diagnostic and sensory applications as they may lead to improved signal-to-noise ratios and lower limits of detection.

Protein Microarray Coatings[2,3]

Fig. 2B compares waveguide-based microchips that were modified with a dodecylphosphate (DDP) monolayer, a poly(glycidyl methacrylate) (PGMA) and a PGMA-*co*-poly(2-(diethylamino) ethyl methacrylate) (PGMA-co-PDEAEMA) polymer brush. The assay that was performed involved first trapping and binding of biotinylated BSA and subsequent detection of the bound BSA using labelled streptavidin. The data clearly indicate that higher intensities are measured on the polymer brush modified waveguides, reflecting the higher protein binding capacity of these coatings.

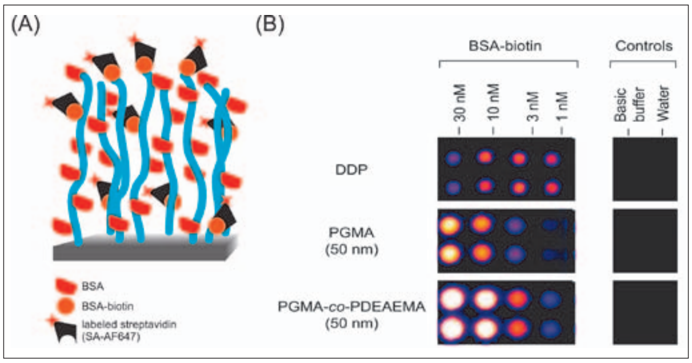

Fig. 2. (A) Biotin-streptavidin assay; (B) Fluorescence read-outs measured on different substrates for this assay (adapted from ref. [3]).

Ion Sensors[4]

Fig. 3 illustrates the use of benzo-15-crown-5 containing polymer brushes for the development of a K^+-selective quartz-crystal microbalance (QCM) based ion sensor. The sensitivity of these brush coatings could be tuned by engineering the thickness of the polymer brush layer.

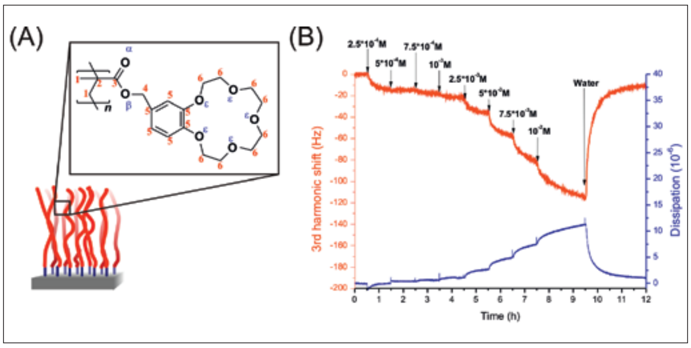

Fig. 3. (A) Structure of the crown-ether brushes; (B) QCM response of a 96 nm thick brush upon exposure to KCl (adapted from ref. [4]).

Conclusions

Polymer brushes are unique platforms to fabricate sensory layers for a variety of applications. While this contribution only discussed two examples, it clearly highlights some of the attractive features offered by surface-initiated polymerization techniques for the fabrication of sensory layers.

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