Polymer brushes on silicon: promising applications as electrochemical capacitors

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Polymer brushes are dense arrays of macromolecular chains tethered on a surface by one end. Their production on different kind of substrates is enabled by the grafting-from approach, in which the polymer is grown directly from a surface functionalized with a proper initiator [1].

We already demonstrated that when the substrate is slightly-doped silicon wafer and the brushes are made of hydrophilic monomers, such as 2-hydroxyethyl methacrylate and methacrylic acid, the electrochemical properties of the former are greatly enhanced and can even be controlled by switching the pH [2,3].

Here we want to describe what happens when brushes of an hydrophobic monomer, such as styrene, are grown instead. The results for ultrathin (10 nm-thick) poly(styrene) brushes, obtained by surface-initiated atom transfer radical polymerization (SI-ATRP), showed that the modified silicon electrode behaves as an almost perfect capacitor. Moreover, in contrast with pristine silicon, this behavior is not influenced by UV irradiation.

Given the interest in the application of polymer brushes for the development of hybrid electronic components and circuitry [4], our results can open a new promising research front.

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