AFM TIPS FUNCTIONALIZED WITH A BIO-INSPIRED POLYMER

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The aim of this study is to investigate at the single-molecule level the adhesive properties of original AFM tips coated with bio-inspired macromolecular chains. The polymer used to achieve this goal is an acrylamide homopolymer of a modified amino-acid.

The modification of AFM tips is based on the electro-initiated synthesis of poly-*N*-succinimidylacrylate. This very simple one-step 'grafting-from' process results in the direct chemisorption of polymer chains onto the tip surface (Figure 1).[1] The activated esters along the polymer backbone pave the way to further easy functionalization at room temperature both in water and in organic solvents. This is an ideal basis for the one-step anchoring of a wide range of nucleophilic compounds like amino groups.[2] We have chosen grafting conditions resulting in an isolated chain regime, so that only one or very few polymeric linkers are tethered to the tip apex.[3] . Dopamine molecules, which are bio-inspired adhesives, were then bonded to the polymer backbone via an amide link, leading to macromolecules bearing catechol groups.

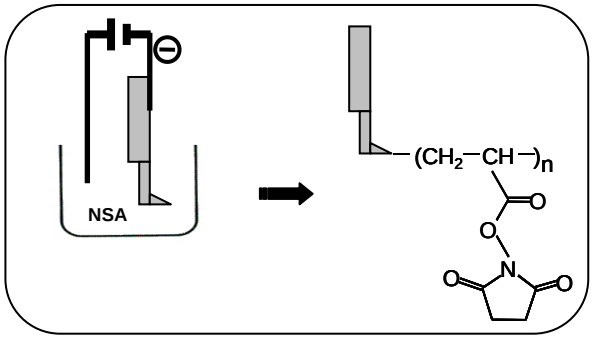

Figure 1: Electrografting of poly-*N*-succinimidylacrylate (P*N*SA) onto Si_3N_4 AFM tips. This results in functional tips that can be derivatized by further reaction with nucleophilic compounds, and thus dopamine.

These original bio-inspired tips were used to perform single-molecule force spectroscopy on inorganic substrates. The specific adhesion forces in water were compared to the ones exerted by simple poly(acrylic acid) chains. It was found that, for identical loading rates, the catechol functions show three times higher forces compared to acrylate units.

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