Feeling sugar-protein interactions using carbon nanotubes : a molecular recongition force microscopy study

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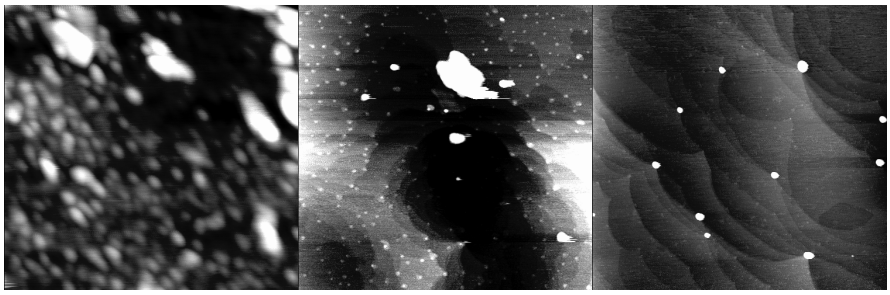
Appendix gold crystal preparation

Preparation of a gold crystal containing a hydroxyl-terminated SAM

The gold single crystal, with a mechanically polished (111) surface, was sputtered and annealed in ultra-high vacuum in order to clean the surface and to allow atomically flat terraces to be formed. This first cleaning step had to be performed only once. The steps that will be described below have to be repeated each time that the gold surface is regenerated.

Before allowing a SAM to form on the gold crystal, possible protein and lipid remainders of the previous experiment had to be removed. First, the crystal was incubated overnight with detergent (Hellmanex 0.5%), rinsed very well with deionized water and dried in a nitrogen flow. Globular features with a diameter of around 20 nm are found on the gold crystal, as can be seen in Figure 1 a. Probably



a **b** **c**

Figure 1 AFM images of three stages in the preparation of a clean Au (111) substrate. All three images were recorded in tapping mode in air, scales are different. (a) Gold crystal after overnight incubation with detergent, rinsed and dried. The AFM image dimensions are 500 nm x 500 nm x 10 nm. (b) Gold crystal after heating in air to 615 °C for 20 minutes. The AFM image dimensions are 1 µm x 1 µm x 4 nm (c) After rinsing with ethanol, and drying with nitrogen. Image dimensions are 2 µm x 2 µm x 10 nm. Most of the contaminant particles originally present on the gold surface are rinsed away, but the low density of residual impurities that act as pinning sites cannot be removed by this method.

these are micelles of detergent. In order to get rid of these, the crystal was heated in air to 615°C for 20 min. This results in a relatively clean surface as is shown in Figure 1 b, which contains much less contamination, and already shows the (111) terraces of the Au crystal. To remove this residual contamination as much as possible, the gold surface was rinsed with ethanol and dried in a nitrogen flow. Most of the particles were removed, although a low density of impurities was still present that acted as pinning sites, Figure 1 c. To remove these, another sputtering and annealing cycle would be necessary. In addition, when forming a SAM, the alkane thiols will compete with the impurities on the surface, and because of the strong gold-thiol bond, the alkane thiols are likely to "win" this competition and form a clean SAM on the gold crystal.

In order to form a SAM, the cleaned gold crystal was incubated overnight in a 2 mM 11-mercaptoundecanol solution, rinsed with ethanol and dried in a nitrogen flow. The gold crystal containing the SAM, imaged with the AFM in tapping mode in liquid is shown in Figure 2.

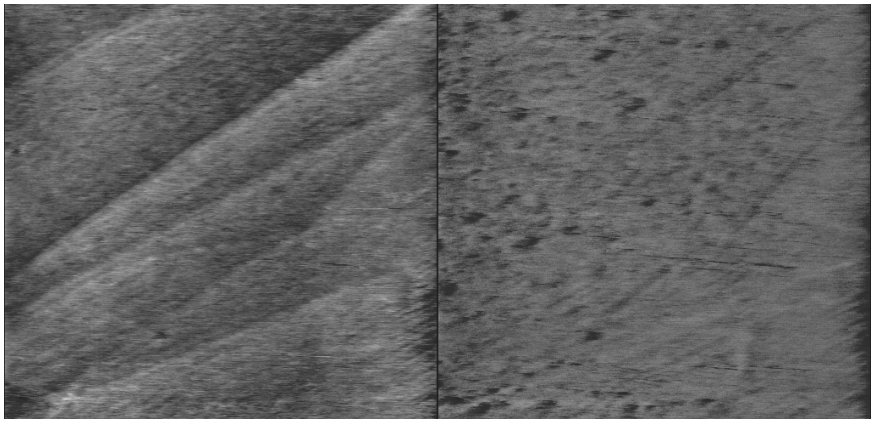


Figure 2 Tapping mode height (a) and phase (b) AFM images of a gold crystal with a SAM of 11-mercapto-undecanol, recorded in 0.01M phosphate buffer at pH 3.4 with a regular tip. Image sizes are 500nm x 500nm x 5nm and 500nm x 500nm x 20°.

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