SELF-ASSEMBLY OF UPRIGHT 1,6-HEXANEDITHIOL MONOLAYERS AS TEMPLATES FOR NANOPART

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Self-assembled monolayers (SAMs) of alkane dithiols are increasingly employed as molecular wires and templates in the chemical construction of advanced electronic devices and sensors. Defect free coverage of the coinage metal (gold or silver) by a stable monolayer, and only one monolayer, with upright alignment of the hydrocarbon chains are important requirements for potential applications. Experimental conditions of the self-assembly have been shown to have drastic effects on the structure of the dithiol SAMs. Depending on the method of preparation alkane dithiols have been shown to adopt a fully extended flat configuration with the molecules lying parallel to the substrate, to form upright monolayers at different tilt-angles, to form covalently coupled multilayers and to undergo oxidation. Evidence is provided in the present communication for the self-assembly of 1,6-hexanedithiol, HDT, from 1.0 mM alcoholic deoxygenated solution to form upright 6.9±1.0 Å thick monolayers on gold substrates if during the adsorption the solution is purged by argon. In the absence of argon purging, long term (> 1000 minutes) exposure of the substrate to alcoholic HDT results in multilayer formation (Figure 1). The time-resolved SPR measurements were performed using the 635 nm incident wavelength and a bicell photodiode detector (Hamamatsu), following the previously described procedure. The thickness of HDT was determined by the two-solvents-technique, in methanol and in ethanol (Figure 2). HDT self-assembly has been found to result in a decrease of the potential under open circuit conditions (Figure 3). The effect of potential control the self-assembly of HDT and nanoparticles onto HDT are discussed.

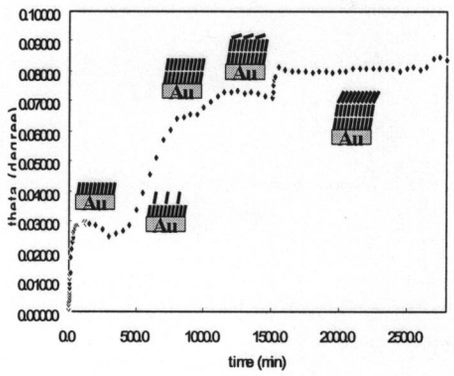

Figure 1 Self-assembly of HDT onto a gold substrate as a function of time in an air saturated 1.0 mM ethanol.

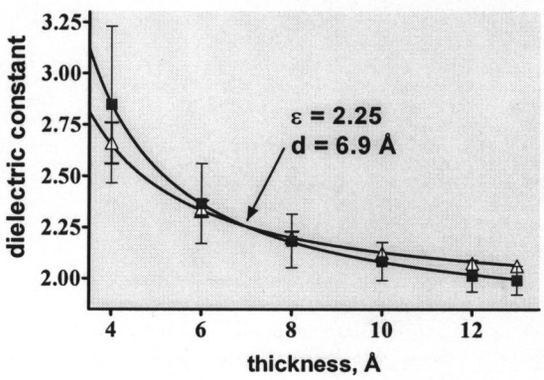

Figure 2 Determination of thicknesses and dielectric constants of HDT SAM by the two solvent approach. Dielectric constant-thickness pairs, plotted for SPR data in methanol (black line) and ethanol (red line) reveal the true average dielectric constant and average thickness of the SAM (the point of intersection).

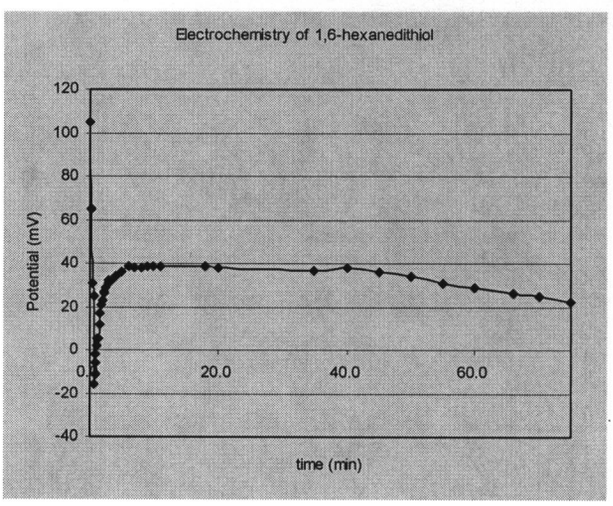

Figure 3 Change of potential accompanying 1.0 mM HDT self-assembly from degassed ethanol under argon, open circuit condition.

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