Electron Transport and Molecular Structure of Self-Assembled Monolayers of Organothiols

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Self assembled monolayers (SAMs) of organothiols on gold bottom electrodes are fascinating test systems to study the electron transport through single molecules by scanning tunneling microscopy (STM). Such studies require a high control over the structure of the SAMs down to molecular dimensions [1,2]. Here we focus our studies on aromatic thiols, which are supposed to show more interesting electron transport properties than simple aliphatic thiols because of the conjugation along the aromatic backbone.

In terms of understanding of how an aromatic headgroup influences the structure of the formed SAMs, investigations concerning the deposition of various 4´-methyl-1,1´-biphenyl-4-alkanethiols (BPs) have moved into the focus of current research interest [3,4]. We have grown SAMs of BPs and of mixed monolayers with alkanes from solution (Fig. 1) and compared the structure of the formed SAMs in terms of topography and electron transport properties via UHV-STM. Using asymmetric tunnel junctions, W(tip) / BP-SAM / Au(substrat), the dependence of the tunnelling current on the tip-substrate distance and the I/V characteristics of the BP-SAMs have been obtained. From these data the decay constants of biphenyls, alkanes and vacuum are extracted and discussed [5].

References:

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Figures:

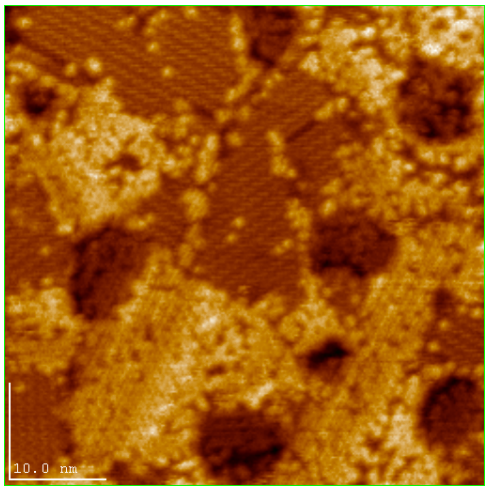

Figure1: Mixed monolayer of dodecane-thiol (C12) and biphenylbutanethiol (BP4). Single molecules of BP4 can be identified in the highly ordered C12 monolayer.