

Atomic Processes at Solid/Liquid Interfaces Investigated by Scanning Tunneling Microscopy

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Many important phenomena naturally take place at solid/liquid interfaces, involving electrochemical oxidation-reduction reactions. Although these phenomena have long been studied, until recently knowledge concerning the atomic and molecular processes that occur at the interfaces has depended on indirect experiments; most previous information resulted from observations made in a high vacuum after removing electrodes from solutions.

In situ STM has now been extended to observations of solid electrode surfaces immersed in liquids, thus allowing direct observation of the solid/liquid interface in its reacting state. One of the most important advancements in this field is a system called *in situ* electrochemical STM.[1] In this system having a four-electrode configuration, the electrode potentials of the substrate and the tip can be independently controlled relative to a reference electrode. In this paper, some of our recent results are presented mainly obtained by using electrochemical STM, such as adlayers of fullerenes (Fig. 1),[2,3] CoPc and CuTPP (Fig. 2),[4] Co porphyrine (Fig. 3),[5] octaethyl porphyrine (Fig. 4),[5] and other organic molecules in solution.

Reference

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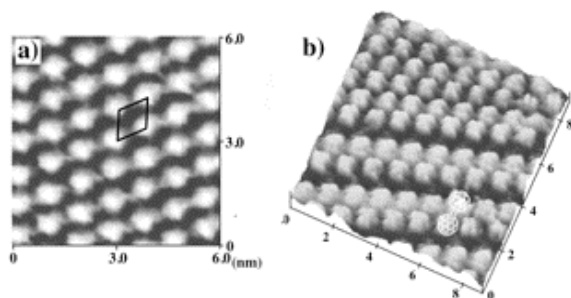


Fig. 1 Electrochemical STM images of fullerene monomers (a) and dimers (b) obtained on Au(111) in 0.1 M HClO₄ solution.

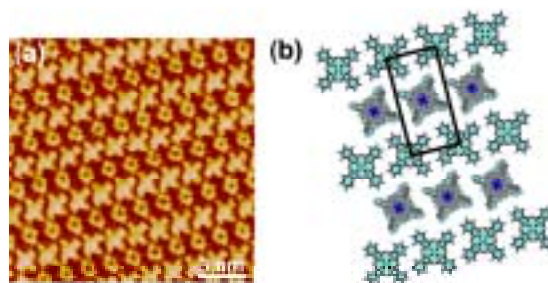


Fig. 2 Electrochemical STM image (a) and the structural model (b) of the adlayer of CoPc and CuTPP coadsorbed on Au(100) in 0.1 M HClO₄.

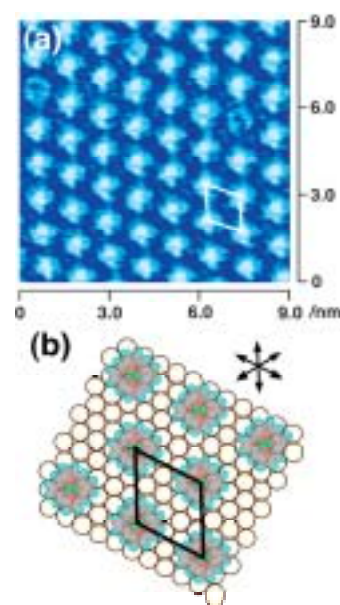


Fig. 3 High-resolution STM image (a) and the structural model (b) of the adlayer of CoP on Au(111) in 0.1 M HClO₄.

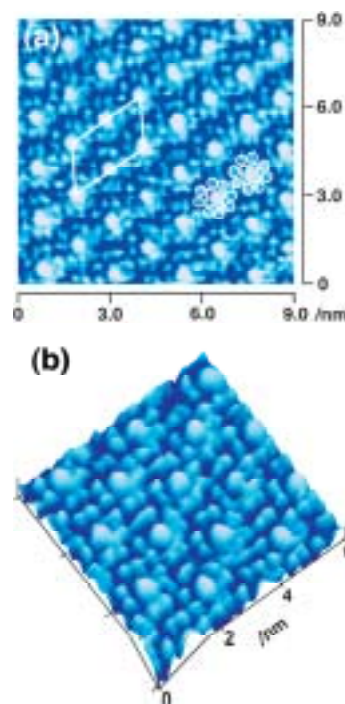


Fig. 4 High-resolution STM image (a) and the height-shaded plot (b) of the adlayer of CoOEP on Au(111) in 0.1 M HClO₄.