Electrochemical Society 201th Meeting - Philadelphia, PA, May 12-17, 2002

"Potential Dependance of the Dynamics of Nanoscale Island Growth and Dissolution at Electrochemical Interfaces by Time-Resolved STM" Y. He and E. Borguet

The potential induced phase transition from the reconstructed Au(111)-(22 x $\sqrt{3}$) unreconstructed Au(111)-(1x1) surface provides a convenient means to generate a low concentration of nanoscale islands. The dynamics of growth and dissolution of these nanoscale islands shows a strong dependence on the electrode potential, that can be investigated by the Potential Pulse Perturbation Time-Resolved Scanning Tunneling Microscopy (P3 TR-STM) technique1,2. Typically, the dynamics of the reconstruction and the island decay are inseparable. In order to independently investigate the reconstruction dynamics and the actual dynamics of the metastable islands, an Asymmetric Potential Pulse Perturbation (AP3 TR-STM) method was developed. The final potential, following the creation of the nanoscale islands, is chosen to lie in the region where the Au(111)-(1x 1) is not stable and the Au(111)-(22 x $\sqrt{3}$) phase does not form. Thus the island decay can be studied without interference from reconstruction. A new intermediate phase, where both islands and reconstruction stripes are absent, is observed. This phase appears to consist of mobile adatoms. The rate of reconstruction from this intermediate state is quite rapid and depends on the duration of the perturbing pulse that creates the islands. The longer the perturbing pulse, the slower the rate of reconstruction.

1. Dynamics of Metastable Nanoscale Island Growth and Dissolution at Electrochemical Interfaces by Time-Resolved STM
Y. He and E. Borguet, Journal of Physical Chemistry B, 105, 3981-3986 (2001).

2. Anisotropic Nanoscale Growth and Dissolution Dynamics in the Presence of a Step: Evidence for a Schwoebel-Ehrlich Barrier at Electrochemical Interfaces
Y. He and E. Borguet, Faraday Discussions 121, in press (2001).