Adlayers of hydroquinone and catechol formed on Rh(111) and Pt(111) in vacuum and in solution

Junji Inukai[1,2], Mitsuru Wakisaka,[2] and Kingo Itaya[2,3]

[1]New Industry Creation Hatchery Center, Tohoku University, Aoba-yama 10, Sendai 980-8579, Japan
[2]Department of Applied Chemistry, Graduate School of Engineering, Tohoku University, Aoba-yama 04, Sendai 980-8579, Japan
[3]Core Research for Evolutional Science and Technology, Japan Science and Technology Agency, Kawaguchi Center Building, 4-1-8 Honcho, Kawaguchi, Saitama 332-0012, Japan

Introduction Adlayers of hydroquinone (HQ) and catechol on electrode surfaces have been studied using a thin-layer cell[1)] or an ultrahigh vacuum-electrochemistry combined (UHV-EC) system.[1)] We formed adlayers of HQ and catechol on Rh(111) and Pt(111) in solution and in vacuum to determine the structures by electrochemical STM in solution and LEED/STM in vacuum.[2,3)]

Experimental Electrochemical STM measurements were carried out in 10 mM HF solutions containing 0.1 mM of HQ or catechol. After the formation of organic adlayers in solution, the samples were transferred into vacuum for LEED measurements. For the formation of adlayers in vacuum, surfaces were exposed to HQ or catechol, and LEED/STM measurements were carried out on the surfaces.

Results Figure 1 shows CV's for Rh(111) in pure 0.1 M HF (a), 0.1 M HF + 1 mM HQ (b), and for HQ-modified Rh(111) in pure HF (c). HQ is seen to be adsorbed on Rh(111), but the adsorbed HQ does not show redox peaks. The adsorbed catechol on Pt or Rh neither showed redox peaks.

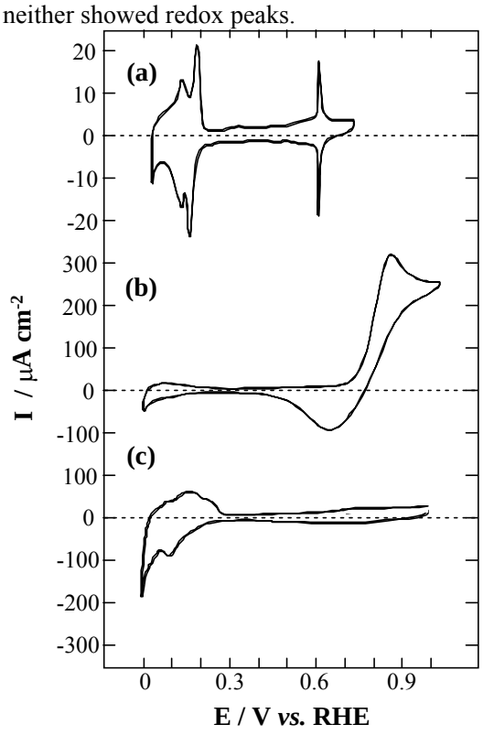

Fig. 1 CV's on Rh(111) in HF.

Figure 2 shows an electrochemical STM image of HQ on Rh(111) observed in 10 mM HF + 0.1 mM HQ and the LEED pattern obtained after emersion. Each molecule is seen to be adsorbed flat on the surface. By using STM and LEED, the structure was assigned as (√7 × √7)R19.1°. The same structure was also formed in vacuum. The adlayer structure of HQ on Pt(111) was found to be incommensurate (2.56 × 2.56)R16° both in solution and in vacuum.

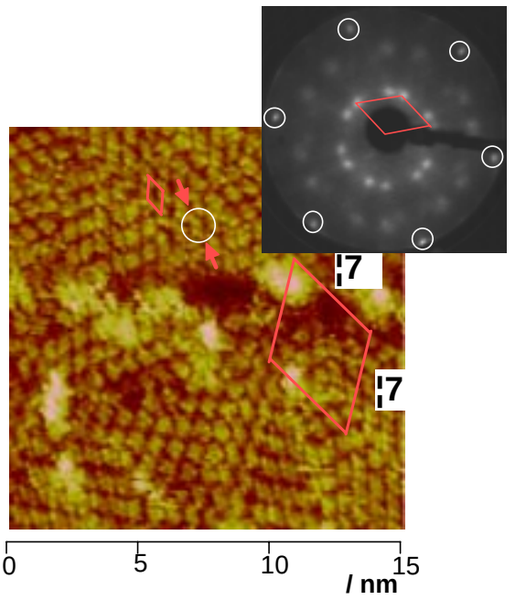

Fig. 2 Electrochemical STM and LEED for the HQ adlayer on Rh(111) formed in solution.

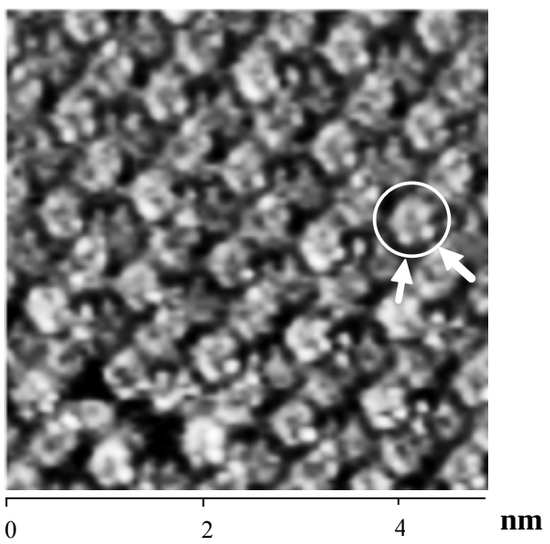

Fig. 3 Electrochemical STM for the catechol adlayer on Rh(111) formed in solution.

Figure 3 shows an electrochemical STM image of catechol on Rh(111) observed in 10 mM HF + 0.1 mM catechol with (√19 × √19)R23.4°. In vacuum, a (√7 × √7)R19.1° structure was observed for the catechol adlayer on Rh(111). On Pt(111), a (√19 × √19)R23.4° structure was formed both in solution and in vacuum.

References

1) A. T. Hubbard, *Chem Rev.*, **88**, 633 (1988).
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3) J. Inukai, M. Wakisaka, and K. Itaya, *Langmuir, submitted.*