

Adlayers of BTA on Cu Singlecrystal Surfaces in HClO₄ Solution

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Introduction As an effective corrosion inhibitor for copper and copper alloys, BTA (C₆H₄N₃H) has been widely used in industrial and technological applications.¹⁻³⁾ We investigated the adlayer structures of BTA on Cu(110), (100), and (111) by using *in situ* scanning tunneling microscopy (STM) in aqueous HClO₄ solution.⁴⁾ BTA molecules were aligned in an orderly manner on well-defined Cu single-crystal surfaces, and the adlayer structure was dependent on the crystallographic orientation of Cu surface.

Experimental Single crystal disks of Cu(110), (100), and (111) with a diameter of 5 mm were used as the working electrode for both electrochemical and *in situ* STM measurements. Electrochemical measurements were carried out using a three-compartment glass cell containing 0.1 M HClO₄ with or without 1 mM BTA. During the STM observations, the potential of the tunneling tip was set at a positive potential to avoid Cu deposition on the tip.

Results Fig. 1 shows CVs on Cu(110), (100) and (111) in the presence and absence of BTA in HClO₄. It is seen that the potential for the hydrogen evolution reaction in the presence of BTA is dependent on the crystallographic orientation of the Cu electrode. By using STM, it was revealed that the BTA molecules were adsorbed in parallel to the surfaces of Cu(110) (Fig. 2) and Cu(100) (Fig. 3), whereas on Cu(111) (Fig. 4) they stacked vertically to form molecular rows. The formation processes of BTA complex at anodic potentials were also observed by STM.

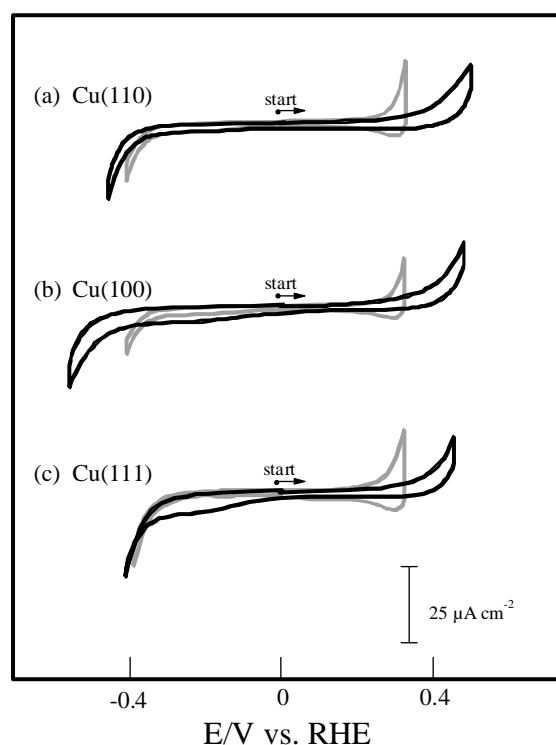


Fig. 1 CVs on Cu(110), (100), and (111) in HClO₄. Scan rate = 50 mVs⁻¹.

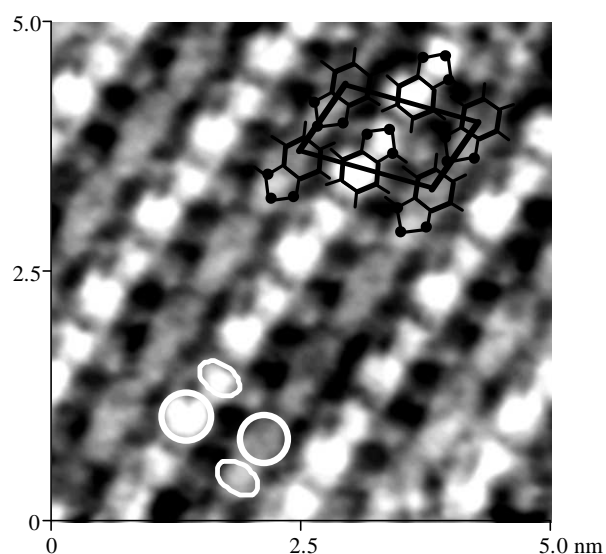


Fig. 2 STM image of BTA on Cu(110).

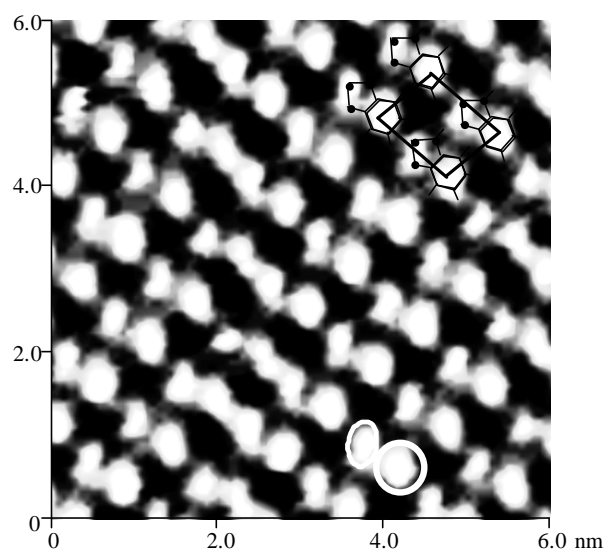


Fig. 3 STM image of BTA on Cu(100).

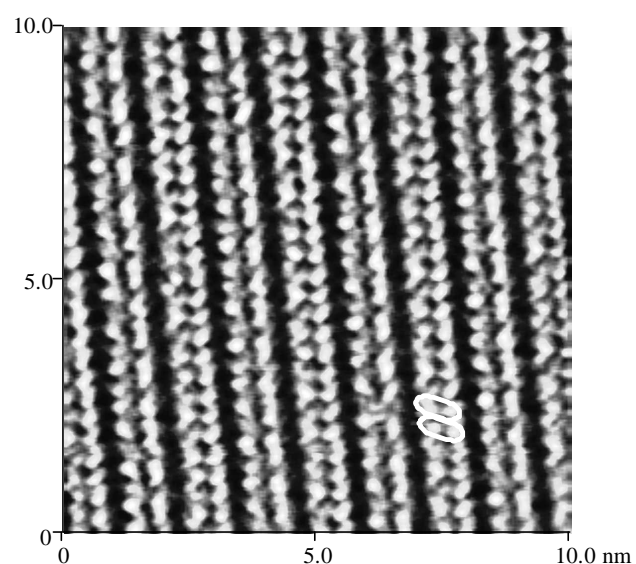


Fig. 4 STM image of BTA on Cu(111).

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