Electrochemical polymerization of pyrrole on Au(111) in sulphuric acid and sodium hexafluoroaluminate solutions monitored by electrochemical scanning tunneling microscopy.

Autorzy

Bartosz Mądry

Maria Grzeszczuk

Klaus Wandelt

Marek Nowicki

Rok wydania

2017

Czasopismo

Journal of Electroanalytical Chemistry

Numer woluminu

786

Strony

154-163

DOI

10.1016/j.jelechem.2017.01.017

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

The early stages of electrodeposition of polypyrrole (PPy) on an Au(111) surface are studied using *in-situ* scanning tunneling microscopy under the electrochemical control of the process. Shape, size, nucleation density and dimensionality of the early growth of the polymer phase was of interest. Electropolymerization took place in aqueous electrolytes containing multicharged anions. The diameter of the smallest detected surface particulates was of the order of a few Å in Na_3AlF_6 solution and a few tens of Å in pyrrole - H_2SO_4 solution. In H_2SO_4 solution, the very early stages of the electropolymerization lead to flat islands with a height of about 2.0 Å and a diameter of several tens of Ångstrom on Au(111) terraces, which indicates the dominance of two-dimensional polypyrrole structures. The surface population of these islands observed in sulphuric acid increases with the number, range, and decreasing potential scan rate of voltage cycles. At later stages and higher coverages the STM images show a further growth of overlapping PPy globules, which change from two- to three-dimensional structures. In aqueous Na_3AlF_6 solution, the STM images showed lifting of the Au(111) surface reconstruction, which may be due to the chemisorption of OH^-. The early polypyrrole deposition in aqueous sodium hexafluoroaluminate, visible with nano-scale horizontal resolution, results predominantly in a 2D growth of the polymer globules having about 2.0 Å in height on the onset of the polymer deposition.

Słowa kluczowe

polypyrrole, Multicharged counter-anions, In-situ scanning tunneling microscopy, Cyclic voltammetry

Adres publiczny

http://dx.doi.org/10.1016/j.jelechem.2017.01.017