البحث الثانى

Cyclic voltammetry growth and characterization of Sn-Ag alloys of different nanomorphologies and compositions for efficient hydrogen evolution in alkaline solutions

Abstract:

Electrodeposition of silver, tin and their alloys from different aqueous electrolytes suffer from various environmental issues and deposits are affected by H2 evolution and metal oxide formation. In this work, these metals and their alloys are electrodeposited by cyclic voltammetry utilizing ionic liquids based on C5H14ClNO (choline chloride) that permits deposit properties control. Both Ag and Sn concentrations in the ionic liquid were varied from 0.01 to 0.15 mol L1. Methionine effect on the reduction potential of Sn and Ag was studied. Different techniques were applied to explore the structures, morphologies, and electrochemical (EC) activities of the deposits. A single Ag3Sn phase with orthorhombic packed structure was observed for all alloys, whereas the preferred growth orientation was varied from (202) to (112) depending on Ag%. Also, the dislocation density is decreased by increasing Ag content. EDX spectra showed only Ag and Sn signals indicating the high purity of the Sn–Ag alloys. The deposit from Sn-rich liquid showed rougher and larger agglomerates at the surface than that formed from the Ag-rich liquids with or without methionine. The electrochemical activities of the deposits toward the H2 evolution reaction (HER) were investigated through electrochemical polarization (ECP) measurements and EC impedance spectroscopies (EISs). The Sn–Ag alloys possess higher performance, as a catalyst for HER using alkaline solution, than Ag or Sn electrodes. The highest rate of HER was recorded for Sn–35% Ag and Sn–97% Ag deposits, which correlated strongly to the microstructure and surface morphology. The ECP results were confirmed by EIS investigations. The measured impedance values are close-fitting to a hypothetical model for the electrode/electrolyte interface

Publishing Date :19/7/2019