Fabrication and Application of A Novel Electrochemical Sensor based on Pt Nanowire Array Coated with Au Nanoparticles

Zhiyang Li (presenter), Calvin Leung, Fan Gao, and Zhiyong Gu*
Dept. of Chemical Eng. – University of Massachusetts Lowell, Lowell, MA 01854
E-Mail: li_zhiyang@student.uml.edu

Abstract

In recent years, various types of nanomaterials have been explored for the development of next-generation electrochemical sensors and devices. Due to the unique properties such as high surface area to volume ratio, nanomaterials have shown enhanced electrochemical performances in many research areas. However, most of the electrochemical sensors based on nanomaterial modified electrodes do not possess sufficient electrochemical properties because of the limitation of their structures and electrode modification methods. In our research, a highly sensitive electrochemical sensor based on vertical nanowire array/nanoparticle hybrid electrode has been developed. The vertical Pt nanowire array has been prepared by an electrodeposition method; then Au nanoparticles are coated onto the surface of the vertical Pt nanowire array by electroless plating. This new sensor structure can overcome several shortcomings of conventional nanowire electrode modification method. First, there is no severe bubble generation problem because no coating layer (such as Nafion) is needed to hold the nanowires on the electrode surface; second, the well aligned array minimizes the overlap of nanowires and provides the maximum surface area of nanowires to react with the analytes. Including the large surface area of Pt nanowires and high density of Au nanoparticles, this novel structure shows excellent electrochemical performances, such as high sensitivity and low limit of detection. The vertical Pt nanowire array/Au nanoparticle hybrid structure can be used as a promising platform for enzyme immobilization and electrochemical/biosensors for quantitative measurement of analytes, such as H_2O_2, glucose, and other biomolecules.