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Entitled

Fabrication, Characterization and Applications of Planar Metallic & Chemically Modified Electrodes from Copper Clad Sheets

by

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Abstract

This thesis is concerned with the development of a fabrication method of planar electrodes by milling and cutting copper clad sheets. The main objectives of this thesis are to produce customized planar electrodes with different geometries with relatively higher reusability compared to the screen-printed electrodes available by commercial vendors. The fabricated electrodes were electroplated with different metals using commercial electroplating baths to produce different metallic planar electrodes. Also, the fabrication of planar electrodes with cavities to be filled with modified carbon paste was done. The electroplated planar electrodes were characterized by cyclic voltammetry technique. In addition to that, platinum-plated electrodes were used to detect hydrogen peroxide (H_2O_2) amperometrically in the flow injection analysis mode. A preliminary experiment was also done to detect glycerol amperometrically using flow injection analysis using copper as the working electrode. The result of the cyclic voltammetry experiments showed that the plated metallic layers exhibit close behavior to their counterpart bulk metallic electrodes. The calculated detection limit for the H_2O_2 detection was found to be 38.4 µM and 48.5 µM for two different shapes of planar electrodes that were used in this study. The electrodes used were able to detect glycerol in the range 10 ppm to 160 ppm in alkaline medium. The described fabrication technique proved suitable to produce planar electrodes of much-enhanced reusability than the screen-printed electrodes. The enhanced reusability is due to their ability to withstand harsh mechanical polishing with sandpapers and then re-electroplate their surfaces again.

Keywords: Screen-printed electrodes; planar electrodes, electroplating; copper, gold; silver; nickel; platinum; cyclic voltammetry; amperometry; flow injection analysis; hydrogen peroxide (H_2O_2); glycerol.