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## Electrooxidation of ethanol using polypyrrole/platinum nanocomposite

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The world's demand for energy has increased dramatically over the last few decades, and will continue to do so. Therefore, it is urgent to find alternative energy sources and perhaps unconventional way of energy conversion with much improved energy efficiency [1]. Fuel cells have received increasing attention because of their high energy-conversion efficiency and environmental affinity [2]. Among different type of fuel cells, direct alcohol fuel cells (DAFCs) were attracting increasing interest as a compact power sources for portable applications, mainly due to the relatively simple handling, storage, and transportation of the fuel [3]. In this study, a nanocomposite surface coating was prepared by electropolymerization of pyrrole by cycling the electrode potential between  $-0.8$  and  $0.8$  V (vs. SCE). Then its surface was potentiostatically coated with platinum nanoparticles at constant potential of  $-0.2$  V (vs. SCE). The resulting electrode was referred as GCE/PPy/Pt. The microscopic structure, and morphology of the polypyrrole (PPy) film was characterized by scanning electron microscopy. The platinum nanoparticles were uniformly dispersed in PPy matrixes, as confirmed by transmission electron microscopy. Energy dispersive X-ray (EDX) analysis was used to confirm the presence of platinum nanoparticles in PPy film. The electrochemical and catalytic activities of the GCE/PPy/Pt were compared with GCE/Pt in  $0.3$  M  $\text{HClO}_4$  solution. The electrooxidation of ethanol on the GCE/PPy/Pt was studied by means of electrochemical techniques. The modified electrode exhibits a significant electrocatalytic activity for ethanol oxidation compared to the other electrodes used in this study. The enhanced electrocatalytic activities may be due to the uniform dispersion of platinum nanoparticles in the PPy film. The effects of various parameters on electrocatalytic oxidation of the ethanol such as the thickness of PPy film, the amount of platinum nanoparticles, ethanol concentration, potential scan rate and the working potential limit in anodic direction were investigated. Finally the Tafel studies of ethanol oxidation are discussed.

**Keywords:** Electrooxidation; Ethanol; Platinum nanoparticles; Polypyrrole

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## Alizarin red S loaded polypyrrole modified glassy carbon electrode for the determination of silver species by anodic stripping differential pulse voltammetry

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Extraction of trace analytes by complexation is an efficient technique for voltammetric determination at chemically modified electrodes. Many of the selective ligands used for non-electroanalytical determinations can be employed successfully with chemically modified electrodes, and retain their selectivities in the immobilized form [1,2]. Polymer coating is one of many different methods used to immobilize the modifier onto an electrode surface [3]. In this study, firstly, the glassy carbon electrode was immersed in an aqueous solution of  $0.1$  M pyrrole containing  $10^{-4}$  M Alizarin red S (ARS), the electropolymerization was carried out potentiostatically at  $+0.75$  V for the 30 s. During the electropolymerization process, Alizarin red S acts as both the supporting electrolyte and the dopant anion. The electrodes, after electropolymerization, were washed thoroughly with purified water and then subjected to several alternative reduction/oxidation steps in a solution containing  $1 \times 10^{-5}$  M silver nitrate. This salt is the only electrolyte present in solution and acts as both supporting electrolyte and counter ion for the reduction step of the polymer. The reduction/oxidation steps were carried out potentiostatically at  $-0.4$  and  $+0.5$  V, respectively, each step for a period of 300 s. The overall processes repeated three times, ending with an oxidation step of 600 s to remove all the silver species from the PPy membrane. The resulting modified electrodes were directly used for voltammetric measurements. Accumulation of silver into the PPy/ARS film electrode was carried out at a preconcentration potential of  $-0.6$  V vs.  $\text{Ag}/\text{AgCl}$  electrode for a period of 200 s by dipping the modified electrode together with the reference and auxiliary electrodes into a sample solution containing the  $1 \times 10^{-5}$  M metal ion. The electrode was removed from the accumulation cell, rinsed with water and then transferred to a cell containing  $0.2$  M potassium nitrate solution adjusted to pH 2.0 for voltammetric measurement. Differential pulse anodic stripping voltammetric (DPASV) experiments were then conducted under quiescent condition. The differential pulse voltammetry was applied in the potential range  $-0.2$  to  $+0.4$  V using a pulse amplitude of  $50$  mV and a scan rate of  $100$  mVs $^{-1}$ . The results indicate that templating the electrodes by applying a potential step program to the electropolymerized PPy/ARS membrane in  $\text{Ag}^+$  electrolyte improves the detectability and selectivity of the electrodes toward silver ion. It seems that by judicious selection of the chelating ligand, and by changing polymerization and templating factors such as film thickness, type of solvent, pH and reaction time, it is possible to induce better selectivity for silver ion.

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## Preparation of Cobalt-Amin Modified Ordered Mesoporous Silica by Electrochemical Sol-Gel and the Study of its Electrochemical Performance

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Over the past two decades, ordered mesoporous silica structures have found considerable attention in the field of material science. Among several important and interesting properties, their high specific surface area and pore volume render them attractive in versatile applications in surface related sciences such as catalysis, separation and electrochemistry. The possibility to functionalize their surface OH groups using either appropriately fine-tuned organic functional groups or commercially available groups is another significant feature of these materials that has been widely used to tailor their properties toward specific