ELECTROCATALYTIC OXIDATION OF METHANOL ON CARBON CERAMIC ELECTRODE MODIFIED BY PLATINUM NANOPARTICLES DISPERSED INTO POLYANILINE FILM

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Recently, direct alcohol fuel cells (DAFCs), due to their relatively high specific energy, easy handling, low price, and easy accessibility are considered as among the power sources for both stationary and portable devices. Among several alcohols which can be used in a DAFC, methanol is generally considered as the most appropriate fuel because it is a liquid fuel of relatively high activity in fuel cell systems [1] and can be nearly completely electro-oxidized to the final product of CO2 due to its simple molecular structure [2]. Platinum or platinum-based materials are the best anodic materials that exhibit catalytic properties for the oxidation process of alcohols to proceed at a sufficient rate in fuel cells [3].

In this study, carbon ceramic electrode (CCE), a new electrode substrate, was prepared by sol-gel procedure and used for the electro-polymerization of aniline and dispersion of platinum nanoparticles into the resulting polyaniline (PANI) film. The resulting Pt nanoparticles were characterized by scanning electron microscopy (SEM). Aniline monomers were polymerized on carbon ceramic electrode by cyclic voltammetry between -0.2 and 1 V (vs. SCE). Then its surface was potentiostatically coated with Pt nanoparticles at -0.2 V (vs. SCE) in an aqueous solution of 0.1M H2SO4 containing 0.002 M H2PtCl6. The electrocatalytic oxidation of methanol at this modified electrode (CCE|PANI|Pt) has been investigated by cyclic voltammetry in a 0.4 M methanol + 0.3 M H2SO4 solution as supporting electrolyte. The presence of polyaniline film significantly enhances the catalytic oxidation of methanol on carbon ceramic electrode. The effects of various parameters on the electrooxidation of methanol such as aniline monomer concentration, thickness of the polymer film, amount of platinum loadings, medium temperature, concentration of methanol, working potential limit in anodic direction, and potential scan rate were investigated in details.

References