



Ethanolectrooxidation onto carbon paste electrode modified with nickel decorated nanoporous nickel phosphate molecular sieve

Mojtaba Gholami-Esfidvajani*, Seyed Karim Hassaninejad-Darzi, Farshad Shajie

Department of Chemistry, Faculty of Science, Babol University of Technology, Babol, Mazandaran, Iran.

Corresponding author E-mail: xmojtabax@gmail.com

Abstract

The VSB-5 nanorods were synthesized by conventional heating for 72 h in the presence of triethylamine as template. Then, a novel, cheap and efficient catalyst for ethanol electrooxidation was developed by decorating Ni²⁺ ions on the surface of modified carbon paste electrode (CPE) with VSB-5 molecular sieves. The electrochemical active surface area of the modified electrode (Ni-VSB-5/CPE) was calculated by cyclic voltammetry (CV). Also, the electrochemical behavior of the Ni-VSB-5/CPE electrode towards the ethanol oxidation was evaluated by CV as well as chronoamperometry methods. A sensitive oxidation peak was observed at 0.55 V in 0.1 M NaOH solution for electrocatalytic oxidation of ethanol with EC' mechanism. It has been observed that VSB-5 at the surface of CPE can improve catalytic efficiency of the dispersed nickel ions toward oxidation of ethanol. The values of electron transfer coefficient, the mean value of catalytic rate constant and diffusion coefficient for ethanol and redox sites were obtained to be 0.657, $1.80 \times 10^5 \text{ cm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ and $3.62 \times 10^{-4} \text{ cm}^2 \text{ s}^{-1}$, respectively. Obtained results from cyclic voltammetry and chronoamperometric techniques specified that the electrode reaction is a diffusion-controlled process. The good catalytic activity, high sensitivity, good selectivity and stability and easy in preparation rendered the Ni-VSB-5/CPE to be a capable electrode for electrooxidation of ethanol.

Safaviet al. [1] was used Ag/Pd nanoalloys modified carbon ionic liquid electrode for electrooxidation of ethanol in alkaline media by cyclic voltammetry as well as chronoamperometry techniques. Research on porous material such as open-framework metal phosphate molecular sieves have attracted considerable attention for applications in catalysis, adsorption, separations, etc [2]. It is important to develop a novel electrode that has high



sensitivity and stability for the electrooxidation of ethanol at anode [3]. It is pointed out that molecular sieves have been utilized for zeolite modified electrodes (ZMEs) and applied in electrocatalysis reaction [2].

Keywords: Nanoporous nickel phosphate, Modified CPE, ethanol electrooxidation, Fuel cell, Alkaline medium

Reference

- (1) Safavi, A.; Kazemi, H.; Momeni, S.; Tohidi, M.; KhanipourMehrin, P., *Int. J. Hydrogen Energy*, **2013**, 38, 3380.
- (2) Samadi-Maybodi, A.; HassaniNejad-Darzi, S.K.; Ganjali, M.R.; Ilkhani, H., *J. Solid State Electrochem.*, **2013**, **17**, 2043
- (3) Tang, J.; Tiang, X.C.; Pang, W.H.; Liu, Y.Q.; Lin, J.H., *Electrochim. Acta*, **2012**, 81, 8.

