

Nickel-nanoparticles for electro-oxidation of ethanol

Sayed Habib Kazemi^{1,*} - Sasan Zaynalpour^{1,2}

¹Department of Chemistry, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, 45137-66731, Iran

²Higher Education Institute of Rab-e Rashid, Tabriz, Iran

ABSTRACT

A modified electrode preparation with cheap materials for the electrocatalytic oxidation of ethanol was investigated in this study. Nickel oxide nanoparticle-modified glassy carbon electrode (NiO-NPs@GCE) was utilized at room temperature (20 °C) for electro-oxidation of ethanol in alkaline media. This electrode can promote the fuel cells anode as an excellent device for producing the energy from ethanol. Decreasing the cost of electrode and increasing the produced energy was reached in our work.

Keywords: Nickel oxide, NiO, Nanoparticle, Electro-oxidation, Ethanol, Fuel cell

1. INTRODUCTION

Direct alcohol fuel cells (DAFCs) using a liquid fuel directly to afford electrical power. Due to low toxicity of ethanol and its facile generation in great quantities from sugar-containing raw materials; ethanol have attracted attention as energy source in fuel cells.[1]. Metals used for alcohol oxidation are consist of Pt, Pd, Mo, Rh, Ru [2] Ti, V, Ce[3] and many other expensive metals. Alternative metals (Ni, Cu, etc.) as low-priced materials for EtOH oxidation is attended to use in fuel cells anode. In this work ,GC electrode was modified with NiO-NPs for electro-oxidation of ethanol. Energy amount produced from this electrode is comparable with those manufactured by Pt or Pd[4].

2. EXPERIMENTAL

We made NiO-NPs@GC electrode as described in ref 6. 1 M sodium chloride and 10 mM nickel nitrate in ammonia buffer (pH=8.5), constitute nickel solution composition. Potential used for electrodeposition of NiO nanoparticles on a GC disc electrode carried out at -1.3 V vs. Ag/AgCl, as apparent surface area of GC electrode was 0.0314 cm². Chronoamperometry, cyclic voltammetry and electrochemical impedance spectroscopy techniques were performed using potentiostat/galvanostat apparatus. SEM observations were performed on a Philips model X30 electron microscope [6].

3. RESULTS AND DISCUSSION

It can be distinguished from SEM micrograph that NiO particles size was between 40 to 60 nm (Fig. 1.).

3.1. Cyclic voltammetry (CV) studies

Electrocatalytic respons of prepared electrode to oxidation of ethanol in 1 M EtOH and 0.1 M KOH solution (scan rate:20 mVs⁻¹) is shown in fig.2.; deposition time of NiO nanoparticles of this electrode was 8 second (t_{dep}=8 sec). All of the curves in this work are related to preparation of electrode with deposition time of 8 second.