Electrocatalytic Oxygen Reduction Reaction on Platinum Nano Particles Modified Copper Phthalocyanine-Multiwalled Carbon Nanotube Composite Electrode

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Since their discovery in 1991, carbon nanotubes (CNTs) have generated huge activity in most areas of science and engineering due to their unprecedented physical and chemical properties. Carbon nanotubes possess many special properties, such as high chemical stability, good electrical conductivity, enhanced mass transport capability and high surface area [1, 2]. Over the past decades, the electrochemical reduction of oxygen has been one of the most studied subjects in the fuel cell area [3]. Metal nanoparticles modified electrodes have drawn particular attention due to their high surface area, effective mass transport, catalysis and control over local microenvironment compared to macro-electrodes. Carbon supported platinum catalyst shows a large surface area and increased catalytic activity for the ORR therefore platinum modified surfaces was widely used in this field [8, 9]. To decrease the cost and increase the electrocatalytic activity of the platinum based electrodes, composite film electrodes have been modified with Pt nano particles with small percentage on the surface.

In this study, multiwalled carbon nanotubes (MWCNTs) were functionalized with acid treatment and thereafter copper phthalocyanine (CuFCN)/multiwalled carbon nanotube composite film electrode was modified electrochemically with Pt nanoparticles. The modified electrodes were characterized with cyclic voltammetry and scanning electron microscopy. The electrocatalytic reduction of oxygen was studied on Pt nanoparticles modified composite electrode in 0.1 M NaOH solution. The obtaining results were compared with bare glassy carbon electrode (GCE), MWCNT/GCE, CuFCN/GCE, CuFCN/MWCNT/GCE and bare Pt electrodes (Fig.1). Pt nano particles modified CuFCN/MWCNT/GCE electrode showed best catalytic activity towards oxygen reduction. In terms of electrochemical measurements, a rotating disk electrode (RDE) was used to elucidate the oxygen reduction reaction (ORR) mechanism. In terms of physical morphological characterization, the structures of catalysts have also been investigated by scanning electron microscopy.

Figure 1. Voltammograms of oxygen reduction at a) bare GCE, b) CuFCN/GCE, c) MWCNT/GCE, d) CuFCN+MWCNT/GCE, e) Pt nano/CuFCN+MWCNT/GCE

KEYWORDS: oxygen reduction, carbon nanotube, nano particles.

REFERENCES: