CHAPTER 4

CONCLUSIONS

MWCNTs were modified with Pt, Au and Pd nanoparticles by reduction and electrodeposition. TEM topographic images and EDX spectra of metal nanoparticles loaded MWCNTs show the round mono-metallic nanoparticles (PtAu-MWCNTs and PtPd-MWCNTs) adsorbing on MWCNTs with small average diameter while dimetallic are rougher than those mono-metallic Au and Pd nanoparticles. Chemical composition analysised by EDX indicates the presence of Pt, Au and Pd catalyst.

The prepared catalysts demonstrate very recognized hydrogen adsorption (H_{ads}) and desorption (H_{des}) regions in the potential region of ca. -0.30 to -0.10 V.

PtAu-MWCNTs electrode, Pt sequentially electrodeposited Au metal nanoparticles loaded carbon nanotube (Au-MWCNTs), was used for the electrocatalytic study of methanol, ethanol and formic acid oxidations. Cyclic voltammograms of the catalyst showed hydrogen adsorption/desorption reactions. The hydrogen desorption peaks imply electrochemically active surface area. Incorporation of Pt in Au-MWCNTs matrix would be able to develope the current intensities for the different catalytic reactions. According to the results, PtAu-MWCNTs catalyst is good for methanol oxidation, ethanol oxidation and formic acid oxidation. Cyclic voltammograms of the Au catalyst showed inactive character for all of methanol, ethanol and formic acid oxidations whereas Pt electrodeposited Au-MWCNTs increases efficiency of electrocatalytic properties in all oxidation reactions.

Moreover, it was found that PtAu-MWCNTs are the best catalyst for formic acid oxidation.

PtPd-MWCNT, Pd, Pt and PdPt catalysts loaded functionalized MWCNTs surface prepared by THPC and sodium L-ascorbate reduction methods, was also performed for the electrocatalytic study of methanol, ethanol and formic acid oxidations. Cyclic voltammograms of the catalysts showed hydrogen adsorption/desorption reactions. Incorporation of Pt with Pd in MWCNT matrix would be able to enhance the current intensities for methanol, ethanol and formic acid oxidations. Cyclic voltammograms show that formic acid oxidation on Pd1Pt3-MWCNTs catalyst is higher than that of methanol and ethanol. Amperometric i – t data shows that Pd1Pt3-MWCNTs catalyst for formic acid oxidation is more stability than others. Moreover, the current density of Pd1Pt3-MWCNTs catalyst loses only 28.52 % compared with others. This indicates that the incorporation of Pd with Pt nanoparticles of Pd1Pt3-MWCNTs are good stability and electroactivity for the formic acid oxidation.

Those results illustrate an outstanding indication of further applications for direct methanol, ethanol and formic acid fuel cell.