Sompoch Jongsomjit 2014: Synthesis and Characterization of Pd-Ni-Sn Electrocatalyst for Use in Direct Ethanol Fuel Cells. Master of Engineering (Advanced and Sustainable Environmental Engineering), Major Field: Advanced and Sustainable Environmental Engineering, Faculty of Engineering. Thesis Advisor: Mrs. Paweena Prapainainar, Ph.D. 143 pages.

The sodium borohydride reduction method was used to prepare different Pd-Ni-Sn electrocatalystic compositions impregnated on carbon black (Vulcan XC-72R) for use in direct ethanol fuel cells (DEFCs). The as-prepared catalysts were mono catalyst, binary catalyst and ternary catalyst using Pd as a base catalyst. X-ray diffraction (XRD) results showed the presence of $Ni(OH)_2$ peak and SnO_2 peak with respect to the Ni content and the Sn content catalysts, respectively. The oxidation number was guaranteed by X-ray photoelectron spectroscopy (XPS). Transmission electron microscopy (TEM) was used to investigate the particle size of catalysts. The average particle size for all types of catalyst was in the range of 5.46-10.56 nm. Energy dispersive spectrometry (EDX) was employed to verify the ratio of metal loadings for all catalyst samples. Scanning electron microscopy (SEM) results demonstrated that the surface morphology was uniform for all catalysts. CO chemisorption was used to verify the number of active sites and the metal dispersion. Cyclic voltammetry (CV) was used to investigate the catalyst activity which associated to the ethanol oxidation reaction (EOR) in 1 M ethanol and in 1M KOH mixture solutions. It was found that the 20%Pd10%Ni10%Sn/CB ternary catalyst exhibited the highest current density of EOR. This composition was further used to be deposited on various supports with and without sulfuric and nitric acids functionalization. In addition, the electrochemical investigations including CO-tolerance, durability and electrochemical surface area (ESA) of catalysts were carried out. The 20%Pd10%Ni10%Sn on acid functionalized multi-walled carbon nanotubes showed the superior electrochemical properties. It is a good catalyst for DEFCs.

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