Kittitat Sodapak 2014: Preparation of Carbon Black for Electrodes in Proton Exchange Membrane Fuel Cells. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Assistant Professor Nanthiya Hansupalak, Ph.D. 79 pages.

The work focused on the entrapment of platinum-loaded carbon black (Pt/C) catalysts in crosslinked chitosan. Factors of interest were the chitosan's molecular weight and epichlorohydrin/chitosan ratio. The work also included the measurement of performance and stability of the H_2/O_2 proton exchange membrane fuel cells, the cathode of which was made of the modified Pt/C. In addition, the effect of Nafion percentage on the electrochemical surface area (ECSA) was measured by cyclic voltammetry. The results illustrated the molecular weight of chitosan 20,000 g/mol exhibited the highest of ECSA value, resulting from the development of three-phase boundary. The performance measurement was conducted under the epichlorohydrin/chitosan ratio (0:1–60:1) in addition the cell temperature (40–90 °C), and the relative humidity (50–100 %RH). The Pt/C modified by using the epichlorohydrin/chitosan ratio of 20:1 and the operating conditions (80 °C and 100 %RH) exhibited the best performance. The epichlorohydrin/chitosan ratio of 20:1 yielded the uniform chitosan coating and well distribution of Pt particles, corresponding to the highest improvement in the ECSA and platinum utilization. Furthermore, the stability of the fuel cell fabricated with the Pt/C modified by using the epichlorohydrin/chitosan ratio of 20:1 (continuously running for 30 h at 40°C and 100 %RH) was slightly better than that of the cell with unmodified Pt/C. In addition, at the epichlorohydrin/chitosan ratio of 20:1, the NFP of 24 % in the catalyst layer gave the highest ECSA value.

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