CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The studied model is the dynamic, two-dimension, two-phase mass transport model of direct methanol fuel cell. The model was used to describe the steady-state behavior, the comparison of single- and two-phase results, and the dynamic behavior. The simulation results were validated with in-house experimental data which experiment in the steady state condition. The simulation results agree well with the experimental data.

For the steady-state behavior, both of reactant concentrations are steeply decreased in catalyst layers. Moreover, the decrease of oxygen concentration from the channel to the catalyst layer is smaller than that of methanol concentration because of the rather low transport resistance of oxygen in the gas phase.

The single- and two-phase models were simulated in steady-state condition. It was found that at high current density, there were some differences between these model results. At high current density, the cell voltage of the single-phase model was higher value than that of another model since the value of the liquid saturation in the ACL was higher than that of another. Therefore, it can be concluded that the two-phase model was significant for study the behavior of direct methanol fuel cell.

For the study of dynamic behavior, the model was used to study the effects of various changes of cell current density. In response to a sudden change, the simulation results showed that the cell voltage gradually increases although the cathode overpotential represented the undershooting in current density since the magnitude of undershooting was low. Moreover, it was found that the causes of cathode overpotential undershoot were the permeation of methanol through the membrane and the change of the oxygen concentration in CCL. While the anode overpotential was insensitive to the change in methanol concentration and CO surface coverage in the ACL. The mass transport of methanol was one of the key factors that influenced the cell dynamic operation.

6.2 Recommendations

The dynamic behavior of direct methanol fuel cell was studied. In this work, the simulation results were compared with the steady-state experimental data. Therefore, the dynamic experimental data are needed to increase the accuracy of the model. Moreover, in this model the flow field in bipolar plate channel which results in the reactant profile and then results behavior of direct methanol fuel cell was not considered.