CHAPTER 1 INTRODUCTION

1.1 Background

Nowadays, there are many researchers studied about direct methanol fuel cell or DMFC. Direct methanol fuel cell is a proton exchange membrane based fuel cell. Although hydrogen gives the highest efficiency and environmental compatibility, there are some problems which are production and storage. Therefore, methanol is produced as alternative fuels. Direct methanol fuel cell is an interesting device which is directly fed methanol in liquid form. It has many advantages which are easy fuel delivery and storage, no need for cooling, and simpler system design. Moreover, there are some problems including the slow kinetics of methanol electro-oxidation and the crossover of methanol. The direct methanol fuel cell value includes complex physical phenomena, such as multi-phase, multi-component, and multi-dynamic transport and electrochemical reactions. Thus, a mathematical modeling is necessary for the study and development of fuel cells, because it gives comprehension about what happen in the fuel cell. At present, many researchers concentrate on steady-state two-phase model of DMFC in order to study the parameters that affect the cell performance [1-6]. Actually, the transient behaviors are also important and need to be investigated since the fuel cell sometimes is change the operating conditions, such as start-up, shut down, or sudden changes in the power level. Hence, in this work, the dynamic model of direct methanol fuel cell is developed and applied to increasingly understand the dynamic characteristics of direct methanol fuel cell. Furthermore, the simulation results were validated with the in-house experimental data.

1.2 Objectives

1. To study the influences of single- and two-phase on steady-state behavior of direct methanol fuel cell
2. To predict and describe the dynamic two-phase behavior of direct methanol fuel cell by mathematical model.

1.3 Scopes of Work

1. The model does not include the flow field domain.
2. The experimental data used to validate is steady-state results.
3. The transient model of direct methanol fuel cell is implemented in COMSOL multiphysics program.

1.4 Expected Results

1. The dynamic behavior of direct methanol fuel cell can be explained.
2. The dynamic behavior of direct methanol fuel cell is more understand.