CHAPTER I
INTRODUCTION

Fuel cells are electrochemical devices that directly convert the chemical energy into electrical energy, heat and water. Among various types of fuel cells, polymer electrolyte membrane fuel cell (PEMFC) is the most promising candidate system as it can be power source in different applications ranging from portable power supplies to transportation. There are several advantages of PEMFC including high efficiency, low operating temperature (70-90°C), rapid start-up and fuel flexibility.

In general, Pt-based electrocatalyst is the most effective catalyst in PEMFC but many its problems still remain such as the low utilization and poor substrate adherence (Colón-Mercado *et al.*, 2006). However, the main problem in PEMFC is the ineffective distribution of precious metal in catalyst layer (O'Hayre *et al.*, 2002). This reduces the performance of fuel cell because of the limited utilization of Pt particles. Finding new direction to improve catalytic efficiency and lower catalytic loading are the critically important parts for PEMFC development.

In order to enhance the Pt utilization and reduce Pt-loadings in electrocatalyst, numerous approaches have been intensively investigated. The approaches are for example, introducing new catalyst-supporting materials to maximize Pt activity (Liu *et a.*,. 2005), using Pt-alloy electrocatalyst (Choi *et al.*, 2004) and developing new electrocatalysts to substitute Pt (Savastenko *et al.*, 2007).

The purpose of this work is to investigate a new method of catalyst fixation design to enhance the activity of Pt in PEMFC by using supramolecule compounds. Here, benzoxazine dimer is used as a host molecule on which a catalytic metal can be deposited (chemisorbed) in the framework as seen in the case of dimer *N,N*-bis(2-hydroxybenzyl)alkylamine-Cu (HBA-Cu) complex (Phongtamrug *et al*,. 2006). The supramolecules embedded with the catalyst at the interface is expected to provide several advantages such as the high active site, the prevention of agglomeration, and the good distribution of the catalyst. This method leads us to an effective way to initiate the function of the catalyst in the membrane electrode assembly (MEA).