CHAPTER I
INTRODUCTION

In today's energy supply system, the conventional energy source is considered to be inadequate for the future. Therefore many researchers attempt to develop renewable energy technologies that can contribute to solve the problems of energy supply and environmental protection. Recently, fuel cells have been drawn attention due to it represents to be an alternative technology for electrical power generation. Hydrogen acts as potential source used as fuel for electrical vehicles and electric power plants, which become more important in the future. According to hydrogen is clean burning source. It is possible to be stored as liquid or gas and distributed via pipelines, so hydrogen energy is expected to be a key solution for the long-term energy (Armor, 1999).

Hydrogen can be produced from wide range sources such as fossil fuels, biofuels and renewable energy, including hydrogen carrier sources, ammonia, and methanol. However, current commercial processes for hydrogen production largely depend on fossil fuels which natural gas is the main feedstock. It represents as potential source since it can be served as the cheapest carbon-containing feedstock. Secondly, there has a large infrastructure for distribution of natural gas. For the time being, it has mature technologies that can produce large capacity of hydrogen.

The well-known processes for hydrogen production via natural gas, mainly containing methane, are steam reforming process. The reaction is the most efficient way to produce a synthesis gas having much higher H_2/CO ratio such a gas composition which is useful for processes requiring H_2-rich gas like fuel cell applications.

For steam reforming catalysts, typically Ni or the noble metals in group VIII are used as active metals in catalysts. Due to its low costs and highly active in steam reforming, ceramic-supported Ni is the most widely used in methane reforming. Although in catalytically efficient, supported Ni catalysts suffer from deactivation. One of the most important components affecting to the catalytic performance is the support. It has to be mechanically strong, stable under steam and high temperature tolerant and resistant to metal support interaction. Among the most common supports for steam reforming, alumina is widely used as commercial catalyst. Nevertheless, it is well-known that Al_2O_3 supported Ni catalysts deactivate easily during the reaction due to coking, sintering of Ni metal, or formation of an inactive $NiAl_2O_4$ phase. Thus many researches attempt to develop the new supported Ni catalyst. But only few studies of methane reforming have been conducted by using Ni supported on zeolite. It was observed that it can contribute higher activity of catalyst. Furthermore, zeolite supports have the potential to deliver very high metal dispersion that is stable combined with a low potential for support metal interaction (Solh *et al.*, 2001).

From preliminarily studied on Ni supported over KL zeolite, it was found that Ni/KL zeolite gave the high activity and stability in both steam reforming and dry reforming because of its low acidity, high thermal stability. From Jeong *et al.*, 2006 reported that the Ni/HY showed the good performance for dry reforming. The main aim of the work is to investigate the catalytic activity of Ni/NaY catalyst. The two series of different preparation techniques were determined the activity and effect of metal loading. The feed ratio is also studied in order to minimize the coke formation. In addition, bench-scale fuel processor testing was performed to produce H_2 approach the goal of 50 l/day by utilizing natural gas as H_2-carrier. Therefore, prior to carry out the bench sale, the effect of higher hydrocarbon in natural gas was studied to prove the impact on the activity of the Ni/NaY catalyst.