CHAPTER I

INTRODUCTION

In recent years, the depletion of our energy resources has become an enormous concern to the future of our existence; hence, extensive research has been emphasized to develop alternative energy resources for more sufficient and more environmentally. There are many new energy sources, such as solar energy in photovoltaic cells and solar cells, wind energy in the windmill and hydrogen energy in fuels cells. Hydrogen becomes meaningful the fuel of choice for the future due to its infinite supply on earth. Hydrogen can be produced, domestically, clearly and cost effectively, from a variety of sources. One of the most realistic hydrogen production methods is the reforming of hydrocarbon fuels, such as natural gas, gasoline, kerosene, or methanol. The products of a hydrogen processing are a mixture of hydrogen (H_2), carbon monoxide (CO) and carbon dioxide (CO_2). However, this mixture is not suitable fuel for the proton exchange membrane (PEM) fuel cell since the anode catalyst of the PEM fuel cell at ~80 °C is poisoned by only 10 ppm. Therefore, several years ago many studies have been attempted to develop a new catalyst of high activity for selective oxidation of CO using in PEM fuel cell applications. Catalysts for CO oxidation usually consist of a noble metal (e.g. Pt, Pd, Au, Ag, Ru, Rh, Rd and Re), and an active O_2 provided support for the oxidizing purpose.

In the last few years, it has been pointed out that there is a strong interest in catalysis by gold (Au) due to its potential applicability into many reactions of both industrial and environmental importance. Au has long been regarded as catalytically for less active than Pt group metals. However, the recent publications have clearly shown that Au is remarkably active for low-temperature oxidation of CO when it is highly dispersed and deposited on metal oxide or zeolites. In addition, it has been studied that small Au particles can be stabilized via inserting Au into the pores of zeolite (Qui *et al.*, 1994).

In the previous work, Naknam *et al.* (2005) studied the preferential CO oxidation reaction in simulated reformed gases over bimetallic AuPt/A-type zeolite catalysts. The results showed that when a small amount of Au was added to the Pt/A zeo-

lite catalyst, the CO selectivity was improved at low temperatures, and 1% AuPt/4A zeolite gave the best performance.

In the preceding article by Wan *et al.* (2005), the effects of the pore structures in the different types of zeolites (Y, β and mordenite) and the reaction activity for CO oxidation have been proposed. These results suggested that smaller Au species were formed in the smaller pores of β or mordenite zeolite; in contrast, larger Au species were formed in the larger pores of Y-type zeolite.

In this study, it was conducted in an attempt to develop a new catalyst for the preferential oxidation of CO in the presence of H_2 over the bimetallic Au-Pt supported on mordenite zeolite and compared to the monometallic Au and Pt supported on mordenite catalysts. All catalysts were prepared by deposition-precipitation. The results of characterization by X-ray diffraction (XRD), BET surface area, temperature-programmed reduction (TPR), Inductively Coupled Plasma (ICP) and Transmission Electron Microscopy (TEM) are presented. The catalytic activities are presented in the terms of CO conversion and CO selectivity as a function of temperature. In addition, the suitable catalyst was used in PROX unit of the bench-scale experimental apparatus for hydrogen production with H_2 production rate of 50 l/day.