CHAPTER I
INTRODUCTION

Development of the proton exchange membrane fuel cell (PEMFC) or polymer electrolyte fuel cell (PEFC) has accelerated during the last 7 years, resulting in increased commercial possibilities for generating clean and efficient power for stationary and mobile source applications. Fuel cells can produce electricity without polluting the environment, and possess the necessary specific power, power density and durability to replace conventional internal combustion engines from their current applications. Furthermore, PEM fuel cell is light in weight, small in size and has high power density at a relatively low operating temperature.

Hydrogen (H_2), methanol (CH_3OH) or natural gas can be used as fuels for fuel cells. H_2 is the primary fuel of PEM fuel cells but it is not possible or safe to store large amounts of H_2 in a vehicle. Steam reforming of CH_3OH, gasoline, or natural gas to H_2 is an important method that can produce the hydrogen needed by the fuel cell on demand. However, H_2 obtained by reforming of hydrocarbons has to be pure because the platinum (Pt) anode of the PEMFC can be easily poisoned by as little as 100 ppm. Therefore, it is necessary to have a simple system that can attain low levels of CO preferably to 10 ppm. There are several methods to eliminate CO from H_2-rich reformed gas such as using a Pt/Pd membrane, which is impractical and expensive. However, the level of impurity is low with the Pd membrane is very low. The second method, methanation has a remarkable efficiency disadvantage, for each mole of CO three moles of H_2, are lost. Finally, selective CO oxidation or preferential CO oxidation (PROX) is the simplest and the most appropriate method. However, it requires addition of oxygen to oxidize CO via CO_2 oxidation reaction. In order to keep the efficiency of the process high; a suitable catalyst with a high selectivity towards CO oxidation and low selectivity to hydrogen oxidation is needed.

Many catalysts including noble metals Pt, Au, Rh, and Ru supported on Al_2O_3 or other oxides have been investigated for use in CO oxidation. Generally, gold has long been regarded as catalytically far less active than platinum group metals. However, it has been clearly demonstrated by many researches that gold is

remarkably active for low temperature oxidation of CO when it is highly dispersed and deposited on metal oxides.

The aim of this research work is to determine the catalytic performance of gold supported on titanium dioxide (Au/TiO_2) for selective CO oxidation in the presence of high amounts of hydrogen and determine the effect of preparation method, gold loading, calcination temperature, and pretreatment conditions for on activity and selectivity.