CHAPTER I
INTRODUCTION

1.1 Introduction

The aim of preparation of catalytic materials is to achieve high activity , selectivity and stability for using any particular reaction. To achieve this purpose, a catalytic metal must be in a sufficiently high dispersed form which generally results in a large specific surface area and consequently gives in a maximum specific activity. This active metal is usually deposited on the surface of a support, a highly porous material to provide a high surface area. In addition, this support material should be able to disperse the metal and has thermostable property and highly mechanical strength (Pinna, 1998).

It has been recognized that the properties of catalysts and catalyst supports normally depend on their preparation methods. For example, the dispersion and size distribution of metal crystallites, their spatial distribution on the support, the homogeneity of components in a multicomponent catalyst, the porosity, the surface area, and the pore size distribution of a support are governed by the precursors used and the treatment temperature and atmosphere, as well as other preparation variables, such as pH of the preparation solution and the use of aqueous or organic medium. In the recent years, significant progress has been made towards an understanding of the relationship between the preparation methods and the final properties of catalysts and catalyst supports. There are many potential oxide materials as catalysts for new commercial applications. A few of these examples include nonporous materials as catalysts for new catalytic hydrocarbon cracking processes, structurally highly stable oxides for use as catalyst supports in automobile exhaust converters and in other extreme conditions of temperature and atmosphere, and compact membranes of well controlled pore diameters for use in energy efficient reactors or gas separation devices (Kung and Ko, 1996).

Over the last decade, the high catalytic activity of nano-size gold has become gradually more and more interesting, although gold is the least active of IB metals (Vogel *et al.*, 1996; and Sakurai and Haruta, 1995). However, gold exhibits exceptionally high catalytic activities at low temperatures in many reactions when finely dispersed gold particles with a diameter smaller than 10 nm are on a support of some metal oxides. (Tanaka *et al.*, 1996). Some examples include carbon monoxide oxidation at low temperatures, hydrogenation of carbon dioxide and carbon monoxide, the reduction of NO to N_2, the catalytic combustion of methanol and its decomposed derivatives, selective partial oxidation of hydrocarbon, methanol synthesis, oxidative destruction of dichloromethane, and also forward and reverse water gas shift reaction (Hayashi *et al.*, 1996; Chen *et al.*, 1996; and Sakurai and Haruta, 1996).

1.2 Research Objective

The experimental approach in this thesis work was to synthesize and characterize a series of highly dispersed gold catalysts on different types of supports (NiO, MnO_2, and Y_2O_3). The effects of gold content in gold doped oxide catalysts and different types of metal oxide supports on the properties of catalysts prepared were investigated. The gold doped oxide catalysts were prepared by both coprecipitation and deposition-precipitation methods. The characteristics of catalysts prepared were determined using BET surface area measurement, X-ray diffraction (XRD), temperature-programmed desorption (TPD), and transmission electron microscopy (TEM).