CHAPTER I
INTRODUCTION

1.1 Introduction

Air pollution which is defined as the addition to our atmosphere of any material(s) having a deleterious effect on life has recently become a serious problem, especially in the large cities of the world. There are several sources of air pollution which can be generated by six major types of sources:

1. Transportation;
2. Domestic heating;
3. Electric power plants;
4. Refuse burning;
5. Forest and agricultural fires;
6. Industrial fuel burning and process emissions (Sell, 1992).

The main pollutants, in the air, are carbon monoxide (CO), oxides of nitrogen (NO_x), unburned hydrocarbon (HC), oxides of sulfurs, heavy metal, soots, polyaromatics, aldehydes, ketones, and nitro-olefins. However, the first four pollutants are very significant in air pollution problem.

Oxides of nitrogen (NO_x) are important elements causing formation of urban smog . They react with hydrocarbons and produce photochemical ozone. When oxides of nitrogen mix with water vapor in clouds, nitric acid a major component of acid rain is produced, and at high altitudes they interfere with the ozone cycle and cause stratospheric ozone depletion. A major source of oxides of nitrogen emission is fuel combustion in engines and power plants. NO_x emissions also can be significant in chemical operations such as nitric acid plants. More recently, the emissions of nitrous oxides (N_2O) from fiber production plants has received attention because of it's global warming effects. NO_x is formed by thermal fixation of nitrogen in the air at very high temperature (>1,500°C). NO_x are mainly formed during combustion, although a few industries also emit these gases from process operations. 43% of the total NO_x is produced from mobile sources where NO_x levels are in the 100 to 3,000 ppm range (Heck and Farrauto, 1995). There are many factors that affect thermal NO_x formation such as oxygen availability, temperature, pressure and residence time in the combustion zone.

Oxides of nitrogen (NO_x) can be divided into six known gas compounds.

1. Nitric Oxide (NO);
2. Nitrogen dioxide (NO_2);
3. Nitrous oxide (N_2O);
4. Nitrogen sesquioxide (N_2O_3);
5. Nitrogen tetraoxide (N_2O_4);
6. Nitrogen pentoxide (N_2O_5).

Nitric oxide (NO) and nitrogen dioxide (NO_2) are the most significant oxides of nitrogen (NO_x), especially nitric oxide (NO). The effect of these gases on humans is not totally clear. However, they do act as irritants to breathing passages, and can cause discomfort of the eyes. NO_2 causes bronchitis, pneumonia, susceptibility to viral infection, and alterations to the immune system (Armor, 1994). NO is the key starting point for all of the other oxides of nitrogen. Moreover, NO is rapidly oxidized by ozone, OH, or H_2O

radicals to form the higher oxides of nitrogen such as NO_2, HNO_2, and HO_2NO_2. Thus, if NO is prevented from entering the atmosphere, most of the downstream effects of NO_x can be eliminated (Armor, 1994).

The control technology of nitrogen oxides is generally divided into two groups. The first group is a technology by which the formation of thermal nitric oxide is greatly suppressed, for example, using catalytic combustion which lowers the combustion temperature to below 1,300°C. The second group is a technology by which the emitted nitrogen oxide is removed by various methods for example catalytic reduction, catalytic decomposition, adsorption, and etc.

Generally, a NO_x decomposition catalyst is required to have at least 2 characteristics : the stability of catalyst is the first required character. This stability includes thermal resistance, anti-poison, and anti-abrasion. The second required character is high activity over a wide range of temperature. Exhaust gas temperature depends upon the change of load on combustion. So the NO_x decomposition catalyst should be active for a wide range of temperature. Up to now numerous metals and their oxides have been tried, but none had sufficient activity to be practical.

One of the most efficient technologies used to control nitric oxide emission is catalytic reduction using hydrocarbon, hydrogen, or carbon monoxide as a reducing agent. In this project, propylene was used as the reducing agent.

1.2 Research Objectives

The objectives of this study were:

i) to prepare alumina supported silver/gold catalysts by using coprecipitation and sol-gel techniques.

ii) to characterize the catalysts by using BET, XRD, and TGA.

iii) to compare the catalyst activity from coprecipitation and sol-gel methods.

iv) to examine the catalyst activity affected by

- calcination temperature.
- silver and gold loading.
- metal loading.
- propylene concentration.
- amount of catalyst used.