CHAPTER I

INTRODUCTION

Air pollution is an important problem in urban and heavily industrialized area where the flow of clean air from surrounding area is insufficient to disperse the accumulations. The carbon monoxide, a product of incomplete combustion or partial oxidation of carbonaceous materials, is the most widely spread gaseous hazard which has an affinity for the hemoglobin of blood 210 times greater than the oxygen affinity [1,2]. The toxicity of carbon monoxide is the result from its reaction with the hemoglobin of blood.

The oxidation of carbon monoxide is an important reaction for cleaning up of emissions from industrial processes and automotive exhausts. For these applications, expensive and rare noble metals are used as catalysts [3]. However, base-metal oxide catalysts have received considerable attention because of their use in automobile emission control systems. For carbon monoxide oxidation, base-metal oxide catalysts, especially copper oxide, exhibit activities per unit surface area similar to those of noble-metal catalysts such as platinum [4]. Huang et al. [5] have reported that high temperature calcination in a reducing atmosphere produced a sintered copper surface but induced a strong metal-support interaction (SMSI) which caused a large increase in activity. Common to each proposed SMSI mechanism is the high temperature reduction of the support by hydrogen [6], hence, the hydrogen spillover plays an important and often a major role,

because the hydrogen spillover will lower the reduction temperature of oxides significantly [7,8]. Platinum is the most effective in this case. A large number of metal oxides can be reduced easily by hydrogen spillover from platinum, resulting in much lower reduction temperature than in the case when the reductant is molecular H_2. Therefore, copper catalyst which was used for CO oxidation, can be promoted by platinum.

In this work, the effect of calcination temperature in a reducing atmosphere on copper catalyst is studied first and then the effect of platinum incorporated in copper catalyst is also studied.

1.1 The Objectives of This Study

1.1.1 To develop the preparation method of supported copper catalysts by platinum for carbon monoxide removal.

1.1.2 To study the effect of the second transition metal on copper catalyst.

1.1.3 To study the ability of the developed catalyst for carbon monoxide removal.

1.2 The Scope of This Study

1.2.1 Studying the effect of calcination temperature in a reducing atmosphere on copper catalysts by varying the calcination temperature from 500 °C to 800 °C and then the following methods were used.

- Testing activity of prepared copper catalysts by using carbon monoxide oxidation reaction.

- Characterizing the prepared copper catalysts by TPD of CO_2, CO Adsorption Capacity Measurements, BET Surface Area Measurements, Electrical Conductivity Measurements, and Chemical Analysis (AA and ICPS).

1.2.2 Studying the effect of platinum by incorporating it onto a copper catalyst.

- The percentage of platinum loading was varied as 0.05, 0.1, 0.3 and 0.5 % (metal/catalyst) and then the prepared platinum-copper catalysts were tested for its activities by using the carbon monoxide oxidation reaction.

- The prepared platinum-copper catalyst, which has a suitable amount of platinum loading, was studied by varying a period of calcination from 1 hr. to 9 hr. in order to find out a suitable period for calcination.

- A group of the prepared platinum-copper catalysts with varying a period of calcination as above-mentioned was characterized by using the same method as mentioned in section 1.2.1.

- The observation of metal-metal interaction between platinum and copper would be done by the method as mention in section 4.3.5.3.