CHAPTER I
INTRODUCTION

One cause of air pollution is exhaust gases from automobile. They seriously affect human's health, the world's atmosphere etc. The toxic pollutants from gasoline engines are combined with suspended particle matter, carbon monoxide (CO), oxides of nitrogen (NO_x) and unburnt hydrocarbons (HCs).

It is necessary to take these pollutants control into action. Many ways of control and treatment of exhaust gases being used are as follows:

1. Improvement of internal combustion engine system
2. Development of new engine design
3. Consumption of others suitable fuels
4. Installation of pollutant control equipment

Nowadays, automobiles always use treatment technology to control exhaust gases before being emitted to atmosphere. The treatment technology is a catalytic converter or three-way catalyst equipped with a muffler [1]. Three-way catalysts (TWC) which perform, at the same time, oxidation of carbon monoxide (CO) and hydrocarbons (HC) and reduction of nitrogen oxides (NO_x), seems to be, up to now, a satisfactory and efficient solution.

Inside of the converter, there are five major components: substrate, support, stabilisers, base metal promoters and platinum group metals. The most commonly used substrate are multicellular ceramic monoliths which have a high open area and exert little back pressure in the exhaust system. Metallic monoliths are also used, especially in situations where the greater open area and even lower back pressure of these system is an advantage. The properties and uses of ceramic and metallic monoliths are reviewed in depth elsewhere and will not be discussed further here. In order to increase the surface area of the monolith, a coating of a highly porous material, usually alumina, is applied. This is known as the washcoat. Stabilisers are often added to the washcoat to maintain the high surface area at the elevated temperature, which are encountered under operating

condition. Promoters are included to improve the activity or selectivity of the catalyst and can have a strong influence on performance [2]. It can be seen that monometallic Pt catalysts are more active than the bimetallic Pt-Rh system when operating at about stoichiometry [3]. In relation to the influence of support on NO reduction, several recent studies suggest that Rh and Pt supported on TiO_2 are more active for NO reduction by CO than that of catalysts prepared using SiO_2 or Al_2O_3 as supports [4].

The aims of this study is to enhance the performance of alumina-supported platinum catalyst (Pt/Al_2O_3) and titanium oxide-supported platinum catalyst (Pt/TiO_2) by various calcination temperature and calcination temperature in a reducing atmosphere. Besides, the research is aimed to study the catalytic activity in the oxidation of carbon monoxide and hydrocarbon including the reduction of NO.

1.1 Thesis objectives

To study effects of the catalyst preparation, i.e., calcination temperature and calcination atmosphere on the catalytic performance of Pt/Al_2O_3 catalyst and Pt/TiO_2 catalyst for abatement of exhaust gases from internal combusion engines under lean-burn and stoichiometric condition.

1.2 The scope of this study

1.2.1 Studying the following parameters of the catalyst preparation on the activity of Pt/Al_2O_3 and Pt/TiO_2:

- Calcination temperature
- Calcination atmosphere, i.e., reducing and oxidizing atmosphere

1.2.2 Studying the effect of catalyst surface form on the catalytic activity:

- Comparison between oxide form and metal form catalysts
- Comparison between metal form and SMSI form catalysts

1.2.3 Studying the effect of oxygen concentration on the catalytic activity for NO, CO and C_3H_8 removal:

- Stoichiometric condition
- Lean-burn condition